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Bulletin No. 2

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THE FLORA

OF THE

FAR NORTH-WEST OF VICTORIA

Its distribution in relation to soil types, and its value in the prevention of soil erosion

By

W. J. ZIMMER, Dip. For., F.L.S.,

Divisional Inspector of Forests

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FOREWORD

A study of the relationship of indigenous flora of soil types is of fundamental importance in land use economy and in the determination of a rational plan for the development of natural resources, but comparatively little published data is available in the field of plant ecology in Victoria.

This Bulletin presents the results of intensive research into the flora of the far north-west regions of the State in its relation to environmental factors, and is of particular value in connection with the phenomenon of soil erosion, which is seriously threatening the productive potentialities of large tracts of valuable land in this part of the State.

Vegetational control is likely to play an important part in effectively counteracting the erosion menace, and in this direction the basic detailed information regarding the native flora and soils of the region contained herein should prove of great value.

The work was first published in 1937. The text has been carefully revised and brought up to date in this new edition, and its value is enhanced by the inclusion of an informative reference map.

A. V. GALBRAITH, Chairman,
Forests Commission of Victoria.

Ham and Eggs Daisy (*Myriocephalus Stuartii*) dominating ground cover. The tree on the left is a Native Pine (*Callitris sp.*). Black Box (*Euc. bicolor*) with Red Gum (*Euc. rostrata*) fringes Lake Hattah in the background.

TABLE OF CONTENTS

	Page
Synopsis	8
Introduction	9
Vegetation Types	9
Climatic Features	10
Vegetation and Soils	12
Vegetation Type 1 (Box Flat Areas)	12
Soils supporting Vegetation Type 1	19
Vegetation Type 2 (Pine-Belar-Buloke Areas)	25
Soils supporting Vegetation Type 2	30
Vegetation Type 3 (Tall Mallee Areas)	34
Vegetation Type 4 (Small Mallee Areas)	37
Vegetation Type 5 (Stunted Mallee Areas)	39
Soils supporting Vegetation Types 3, 4 and 5	46
Vegetation Type 6 (Salt-bush Plains)	54
Soils supporting Vegetation Type 6	58
The Relationship between Soils and Vegetation	61
Plants as Soil Indicators	66
The Return of Vegetation on Protected Areas	67
The Effect of Settlement on Vegetation and Soils	68
References to Literature	75
List of Indigenous Plants found growing in the Area under discussion	76

SYNOPSIS

Information regarding rainfall and temperature is set out.

The vegetation has been divided into types, the occurrence of the species noted, and tables prepared showing the species present in the various vegetation types.

Soils supporting the several vegetation types have been grouped into four main divisions, and have been described from their appearances together with textures ascertained by comparison of field samples with recognized soil textures. The information has been summarized, and figures which show the profiles diagrammatically are included.

The relationship between the vegetation types and soil divisions has been briefly discussed.

That the occurrence of the same species in more than one soil group is not necessarily due to affinity of soils is mentioned. A table has been prepared showing the number of species occurring in more than one soil group.

The value of plants as soil indicators has been discussed, and the various species which are apparently confined to soils of each group have been named.

The effect of settlement on vegetation and soils has been discussed. Species which are uncommon or rare, and those likely to become extinct, are given.

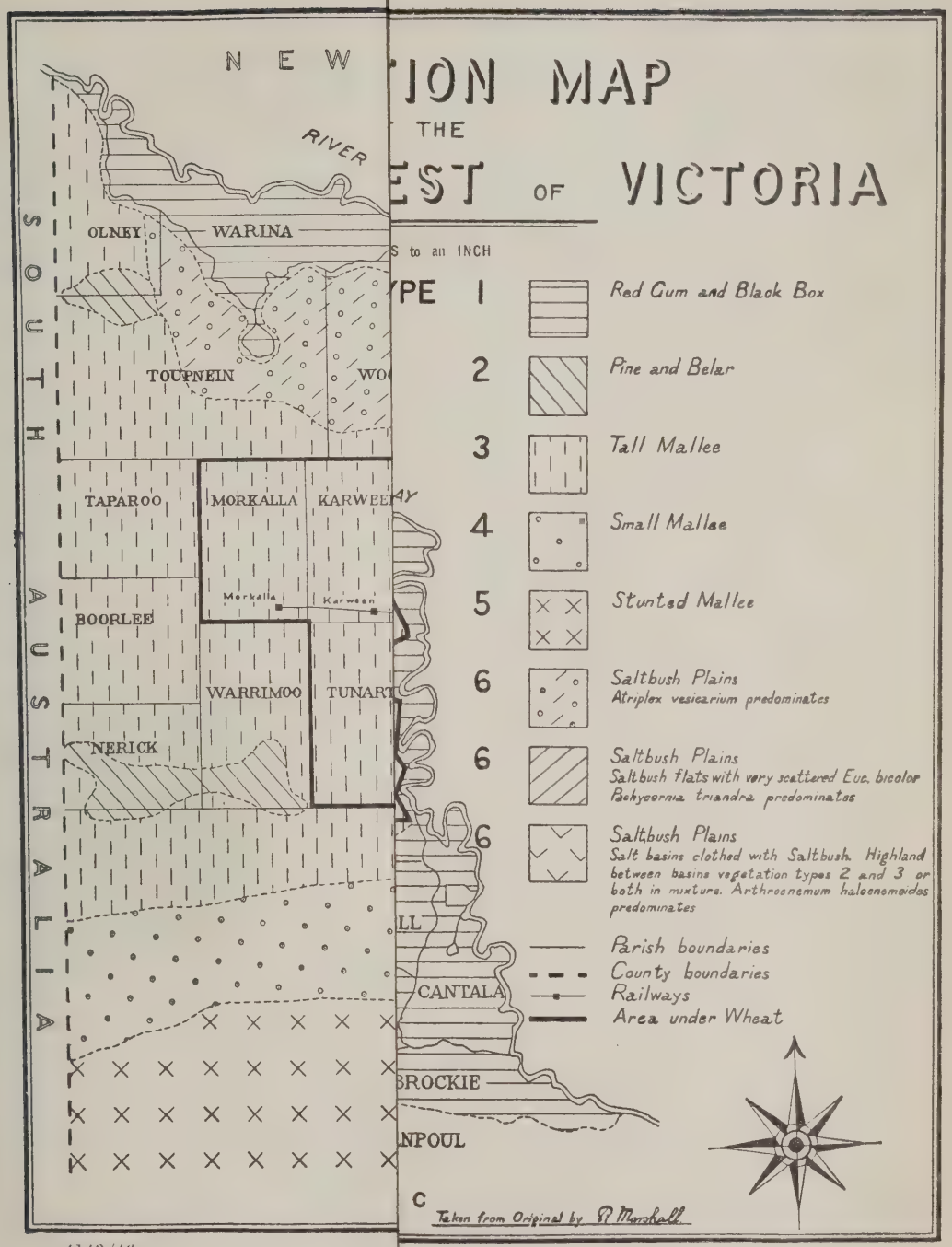
The causes of soil erosion have been stated, and the plants most useful in preventing such erosion have been specified.

A list is given of the indigenous flora found in the area under discussion. This includes both botanical and common names.

ACKNOWLEDGMENTS

Thanks are expressed to:

Dr. R. T. Patton and Mr. E. J. Sonenburg, of the Botany School, Melbourne University, for their assistance in the botanical identification, Mr. K. V. Ferguson, of the Forests Commission, for photographs, Mr. L. G. Chandler, of Red Cliffs, for the frontispiece, and to Mr. R. Marshall for taking off the vegetation map from the original plan.


N E W
RIVER
SOUTH AUSTRALIA
OLNEY
WARINA
TOUPNEIN
TAPAROO
MORKALLA
KARWEEY
Morkalla
Karween
BOORLEE
WARRIMOO
TUNART
NERICK
CANTALA
BROCKIE
NPOUL
ION MAP
THE
EST OF VICTORIA
S to an INCH
YPE 1
Red Gum and Black Box
2
Pine and Belar
3
Tall Mallee
4
Small Mallee
5
Stunted Mallee
6
Saltbush Plains
Atriplex vesicarium predominates
6
Saltbush Plains
Saltbush flats with very scattered Euc. bicolor Pachycornia triandra predominates
6
Saltbush Plains
Salt basins clothed with Saltbush. Highland between basins vegetation types 2 and 3 or both in mixture. Arthrocnemum halocnemoides predominates
Parish boundaries
County boundaries
Railways
Area under Wheat
Taken from Original by R Marshall

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VEGETATION MAP
OF THE
FAR NORTH WEST OF VICTORIA

SCALE—NINE MILES to an INCH

NEW SOUTH WALES

SOUTH AUSTRALIA

RIVER MURRAY

WENTWORTH

RIVER MURRAY

OLNEY
WARINA
TOUPNEIN
WOOLWOOLA
MULLROO
WALLPOLLA
TULILLAH
YELTA
WARGAN
MERBEIN
MILDURA
Vines
RED CLIFFS
TAPAROO
MORKALLA
KARWEEN
MERINGUR
YARRARA
WERRIMULL
MURRNROONG
KARAWINNA
MERRINEE
BENETOOK
Benetook
Yatpool
BOORLEE
CINQUAM
YATPOOL
KARADOC
WARRIMOO
TUNART
MALLOREN
KOLEYA
TARRANGO
YARAMBA
WILLAH
Carwarp
CARWARP WEST
CARWARP
NERICK
KURNWILL MALLANBOOL
RAAK
Boonoonar
COLIGNAN
NURNURNEMAL
Nowingi
KONARDIN
YELWELL
CAROOL
NOWINGI
CANTALA
BROCKIE
BITTERANG
Hattah
WALPAMUNDA
MOURNPOUL
MILLEWA
KARKAROOC

TYPE 1 — Red Gum and Black Box

2 — Pine and Belar

3 — Tall Mallee

4 — Small Mallee

5 — Stunted Mallee

6 — Saltbush Plains
Atriplex vesicarium predominates

6 — Saltbush Plains
Saltbush flats with very scattered Euc. bicolor
Pachycornia triandra predominates

6 — Saltbush Plains
Salt basins clothed with Saltbush. Highland
between basins vegetation types 2 and 3 or
both in mixture. Arthrocnemum halocnemoides
predominates

Parish boundaries
County boundaries
Railways
Area under Wheat

Taken from Original by S. Marshall

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INTRODUCTION

The boundaries of the area under discussion may be taken as follows :—

The Murray River on the north, the South Australian Border on the west, a line east from the South Australian Border to Hattah, and thence easterly to the River Murray at Wemen, enclosing an area of approximately 4,000 square miles.

The species referred to cover 67 families, 217 genera, and 449 species. A complete list appears at the end of this treatise.

It is not intended to deal extensively with the families *Gramineae* and *Chenopodiaceae.*

VEGETATION TYPES.

The vegetation of the far north-west of Victoria can be divided into *six* chief types, namely :—

Vegetation Type 1 .. Box Flat Areas, subject to periodical flooding.
Vegetation Type 2 .. Pine–Belar–Buloke Areas.
Vegetation Type 3 .. Tall Mallee Areas.
Vegetation Type 4 .. Small Mallee Areas.
Vegetation Type 5 .. Stunted Mallee Areas.
Vegetation Type 6 .. Salt-bush Plains.

Vegetation Type 1 supports abundant *Eucalyptus bicolor* and to a lesser degree other characteristic species.

Vegetation Types 2 and 3 are alike, but the appearance of certain species enables a distinction to be made between them. While Type 2 supports mainly *Callitris spp.* and *Casuarina spp.*, Type 3 more generally supports Tall Mallee (*Eucalyptus spp.*).

Vegetation Type 4 is characterized by the smaller growth of Mallee (*Eucalyptus spp.*) smaller than the Mallee found in Type 3, but larger than the Mallee occurring in Type 5. *Triodia irritans* also appears.

Vegetation Type 5 is largely comprised of Stunted Mallee (*Eucalyptus spp.*) with *Triodia irritans* in great abundance. The appearance of certain other species confined to this type is well defined.

Vegetation Type 6 is easily distinguishable.

At the conclusion of the description of each vegetation type, tables have been prepared with the object of showing clearly the occurrence of the plants.

Separate tables for the types will be found, as follows :—

Table 2—Box Flat Areas (Type 1).
Table 4—Pine–Belar–Buloke Areas (Type 2).
Table 6—Mallee Areas (Types 3, 4 and 5)
Table 8—Salt-bush Plains (Type 6).

The occurrence of any of the species in more than one type is recorded, together with information as to their relative abundance.

The plants have been divided into *four* groups :—

Group 1	.. ..	Trees.
Group 2	.. ..	Shrubs.
Group 3	.. ..	Small Plants—often seasonal.
Group 4	.. ..	A special group termed " others ".

Plants in Group 3 are represented in the tables so far only as they have been observed. Seasonal conditions may cause some variation in distribution.

Group 4 may be considered to embrace Grasses, Rushes, and Salt-bushes, which have special characteristics, and also partial parasites which, by virtue of their mode of life, are not brought into direct relation with soils.

The soils supporting the various vegetation types have been divided into *four* divisions, namely :—

Division 1 ..	The soils of which support Vegetation Type 1.
Division 2 ..	The soils of which support Vegetation Type 2.
Division 3 ..	The soils of which support Vegetation Types 3, 4 and 5.
Division 4 ..	The soils of which support Vegetation Type 6.

The information regarding soils is not the product of chemical and mechanical analyses, but has been obtained in the field by a comparison of soils with samples of the various soil textures kindly supplied by Mr. T. J. Marshall, of the Waite Institute, Glen Osmond, South Australia.

The amounts of calcium carbonate and gypsum remarked upon, refer only to visible quantities in the profile.

Rough reaction tests have been made by using a Hellige Pehameter.

It should be noted that the boundaries shown on the vegetation map separate the area into zones, within which each vegetation type is represented as being the predominant type. Small areas of some of the other types often occur within the main divisional lines.

CLIMATIC FEATURES.

Official meteorological data for the area under discussion are summarized in Table 1. The official records from the Commonwealth Meteorological Bureau extend over a short range of years for Werrimull, Willah, Meringur, and Hattah, and concern rainfall only. Official temperatures are available for Murrayville and Mildura (see Locality Map).

Rainfall records covering a few years are often unreliable, as the data obtained therefrom may be affected by a sequence of good or bad seasons. Although the yearly average over the whole area under discussion is mostly between 10 and 11 inches, the average for Murrayville over a period of 24 years is nearly 13 inches. Willah and Hattah show an average annual rainfall of 12·81 inches and 12·01 inches respectively, these figures being based on periods of seven and six years respectively. It is considered that the annual averages for Willah and Hattah are too high, and that they would be reduced if records were available over a longer period.

Table 1 shows the average annual rainfall to be low. Owing to the semi-arid nature of the area, wheat lands are dependent on a scanty and irregular rainfall, and the vineyards of Mildura, Merbein, and Red Cliffs rely entirely upon irrigation from the Murray River. Generally speaking, the wettest months are from May to October inclusive.

TABLE 1.—OFFICIAL METEOROLOGICAL DATA FOR MILDURA–MERBEIN–MURRAYVILLE–RENMARK (S. AUST.)–WERRIMULL–WILLAH–MERINGUR–HATTAH.

Place.	Number of Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total Points.
Mean Rainfall.														
Mildura ..	45	53	75	81	66	108	130	84	112	100	102	79	80	1,070
Merbein ..	14	35	82	71	66	121	127	95	93	93	88	76	69	1,016
Murrayville	24	47	108	65	66	151	142	114	149	158	120	88	85	1,292
Renmark ..	?	50	80	41	52	124	124	82	127	122	95	69	84	1,050
Werrimull ..	5	20	88	63	59	122	111	78	116	81	96	69	111	1,044
Willah ..	7	39	139	116	83	102	138	111	137	100	141	98	77	1,281
Meringur ..	7	46	119	71	47	93	118	84	113	82	98	105	95	1,071
Hattah ..	6	33	134	62	50	187	104	76	153	149	112	83	58	1,201
Temperature.														Yearly Average.
Mildura—														
Mean minimum ..	38	61·6	62·0	56·1	49·8	45·0	41·3	39·5	41·8	45·6	50·1	55·2	59·1	50·6
Mean maximum ..	38	91·6	91·9	84·6	76·0	67·0	60·8	59·5	63·9	69·7	77·3	85·0	89·5	76·4
Murrayville—														
Mean minimum ..	8	54·3	56·2	51·8	47·8	43·1	37·2	37·3	37·1	39·6	44·6	50·0	53·4	46·0
Mean maximum ..	8	87·0	89·8	84·0	77·5	65·4	59·4	58·9	61·0	67·4	74·4	82·9	85·1	74·3

VEGETATION AND SOILS.

VEGETATION TYPE 1

Box Flat Areas.

Eucalyptus rostrata follows the more permanent water courses, the low banks of the Murray and edges of billabongs, swamps, lakes and creeks which are fed from the main stream.

Eucalyptus bicolor is found on land subject to flooding, but since it is not as moisture-loving as *rostrata*, it extends further from the damper situations. Observation has shown that *bicolor* extends over all country subject to high floods, with the exception of very low areas, and a definite line of high flood levels is marked out by the occurrence of this tree.

Eucalyptus bicolor (Black Box)—Kulkyne.

Following the course of the Murray, the predominating tree vegetation is Black Box and Red Gum, occasionally interspersed with patches of plants belonging to other vegetation types. These latter plants appear always on red soils at levels beyond the reach of flood waters. Low land along the Murray is invariably grey in colour.

On the high lands, where entirely different soils are found, *Callitris robusta*, *Hakea leucoptera*, *Eremophila longifolia*, *Heterodendron oleifolium* and other species occur. This type of vegetation is consistent with species found on similar soils in areas which form extensive belts in other parts of the area under discussion. Thus evidence is afforded that soil has a marked effect in the production of certain species.

Low-lying patches of Lignum (*Muehlenbeckia Cunninghamii*) are scattered throughout Vegetation Type 1. *Eucalyptus bicolor* in these places is infrequent, and very often disappears altogether. This absence is accounted for by the frequent and lengthy periods of inundation.

Other important trees and shrubs which occur, are as follows:—*Acacia stenophylla*, *Acacia salicina*, *Acacia Victoriae*, *Fusanus acuminatus*, *Pittosporum phillyreoides*, *Templetonia egena*, *Melaleuca pubescens*, *Eremophila maculata*, *Eremophila bignoniiflora*, *Heterodendron oleifolium*, *Casuarina lepidophloia*. Numerous smaller plants appear which are listed elsewhere.

Of the plants abovementioned, certain species are confined to Box Flat areas, but others are also to be found in other vegetation types. *Eremophila maculata* extends to red soils about Carwarp, and to the Belar "flats" near Merbein. *Acacia Victoriae* appears to be more at home on red soil areas near the Murray. The same may be said regarding *Pittosporum phillyreoides*, which is to be found fairly generally in certain other vegetation types. Although not often found growing with Box, it is met with over a wide range in all kinds of situations excepting in arid parts, whereas *Acacia Victoriae* is not plentiful and is confined mainly to Vegetation Type 3.

Fusanus acuminatus is rare on Box flats, where it is locally termed the Box Quandong. This tree is mixed with Pine-Belar, associated with Sandalwood (*Myoporum platycarpum*) and Mallee, and also occurs frequently on the extremities of the salt lake areas west of Nowingi, but it does not occur in sandhill country where *Fusanus persicarius* (Ming) grows. Sweet Quandong (*Fusanus acuminatus*) prefers a better soil.

Templetonia egena also is to be found mixed with Pine-Belar, but does not encroach on the Mallee areas.

Melaleuca pubescens and *Callistemon brachyandrus* follow the edges of flats and swamps, and are there associated principally with *Eucalyptus bicolor*.

Eremophila bignoniiflora is found occasionally mixed with *Eucalyptus bicolor*, and is confined to Box flats. *Eremophila polyclada* is very rare in similar situations and does not occur elsewhere. *Eremophila divaricata* is common along the Lower Murray, preferring the damper situations.

It is therefore apparent that the largest and most important growths on Box flats are *Eucalyptus rostrata*, *Eucalyptus bicolor*, *Acacia stenophylla*, *Acacia salicina*, *Eremophila bignoniiflora*, *Eremophila polyclada*, *Eremophila divaricata*, *Melaleuca pubescens*, *Callistemon brachyandrus* and *Myoporum montanum*, whereas *Acacia Oswaldii*, *Acacia Victoriae*, *Pittosporum phillyreoides*, *Eremophila maculata*, *Templetonia egena*, and *Fusanus acuminatus* grow as well on different soils in association with totally different species in areas far removed from the influence of the river.

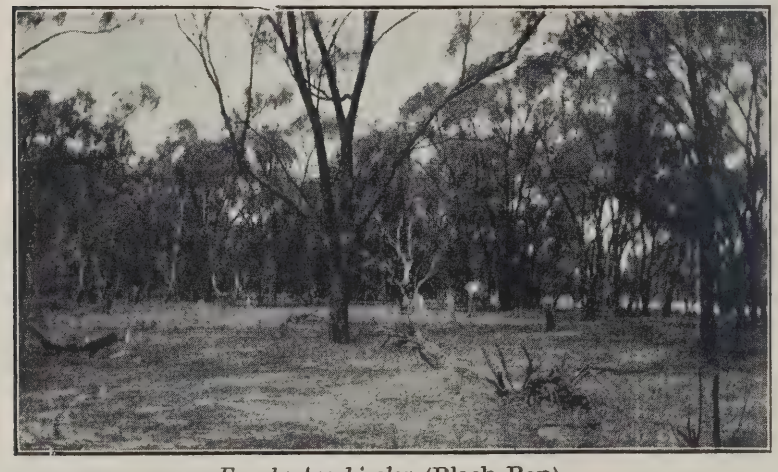
Rare instances of *Casuarina lepidophloia* and *Callitris robusta* appearing in Vegetation Type 1 have been noticed. Occurring on isolated small sandy rises within Box Flat areas and close to the river are *Dodonaea attenuata*, *Ajuga australis*, *Trichinium alopecuroideum*, *Swainsona phacoides*, *Swainsona microphylla*, *Psoralea tenax*, *Psoralea eriantha*, *Lotus australis* and *Zygophyllum apiculatum*.

Panicum decompositum, *Digitaria divaricatissima* and *Aristida arenaria* are the chief grasses, but only occur in open tussocks and not in a thick carpet. These areas are limited in number and size.

To return to the Box flats, *Chloris truncata* and *Chloris acicularis* appear, and are usually only found in damp flats. The Mallee Love Grasses, *Eragrostis Dielsii* and *Eragrostis falcata*, are confined to drier Box localities, while *Glyceria ramigera* is sometimes located near billabongs and swamps. Clinging closely to well-watered billabongs timbered with *Eucalyptus rostrata*, *Paspalidium jubiflorum* grows abundantly, and occasionally *Pollinia fulva* appears. This grass has not been noticed to any extent west of Kulkyne, where it is fairly common. These two grasses usually do not extend beyond well-watered areas. The occurrence of *Marsilia Drummondii* in low areas is marked.

Swainsona Greyana, although doubtfully recorded for Victoria (1), definitely grows on the Victorian side of the Murray, but is confined to Vegetation Type 1 areas below the junction of the Darling and Murray Rivers. Other plants similarly occurring are *Crinum flaccidum*, *Eremophila polyclada*, *Phyllanthus lacunarius*, and *Abutilon Theophrasti*. As these plants are rare and do not occur upstream from the junction of the Darling River with the Murray, it is suggested that the waters of the Darling are responsible for their presence in Victoria.

Vegetation Type 1.



Eucalyptus bicolor (Black Box).

TABLE 2.—VEGETATION TYPE 1.

(*Box Flats.*)

Group 1—Trees — Prominent (P)
Group 2—Shrubs and Semi Shrubs — Frequent (F)
Group 3—Small Plants often Seasonal — Occasional (O)
Group 4—" Others " — Rare (R)

" x " indicates occurrence.

Group No.	Species.		Occurrence in Vegetation Types—					
			1.	2.	3.	4.	5.	6.
1	*Eucalyptus rostrata*	P	X	..	..	..	..	..
	Eucalyptus bicolor	P	X	..	..	..	..	..
	Eucalyptus odorata var *calcicultrix*	O	X	..	..	..	..	..
	Fusanus acuminatus	O	X	X	X	..	..	..
	Pittosporum phillyreoides	O	X	X	X	..	..	..
	Acacia salicina	F	X	..	..	..	..	..
	Acacia stenophylla	F	X	..	..	..	..	..
	Acacia Oswaldii	F	X	X	X	X	..	..
	Acacia Victoriae	O	X	..	X	..	..	..
	Acacia homalophylla	R	X	..	X	..	..	..
	Callistemon brachyandrus	O	X	..	..	..	..	..
	Melaleuca pubescens	F	X	..	X	X	..	..
	Eremophila bignoniiflora	O	X	..	..	..	..	..
	Heterodendron oleifolium	O	X	X	X	..	..	..
	Callitris robusta	O	X	X	..	..	..	..
	Casuarina lepidophloia	O	X	X	..	..	..	..
2	*Platylobium obtusangulum*	O	X	..	..	..	..	..
	Templetonia egena	O	X	X	..	..	..	..
	Solanum esuriale	F	X	..	X	..	..	..
	Solanum simile	F	X	..	X	..	..	..
	Eremophila maculata	F	X	X	X	..	..	..
	Eremophila divaricata	F	X	..	..	..	..	..
	Eremophila polyclada	R	X	..	..	..	..	..
	Myoporum montanum	O	X	..	..	..	..	..
	Myoporum parvifolium	O	X	..	..	..	..	..
	Chenopodium nitrariaceum	P	X	..	..	..	..	..
	Muehlenbeckia Cunninghamii	P	X	..	..	..	..	..
	Glycyrrhiza acanthocarpa	O	X	..	..	..	..	..
	Sida corrugata	O	X	..	..	..	..	..
	Exocarpus stricta	O	X	..	..	..	..	..
	Pimelea microcephala	R	X	..	X	..	..	..
	Senecio Cunninghamii	O	X	..	..	..	..	..

TABLE 2—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Bulbine semibarbata*	F	X	..	X	..	..	..
	Crinum flaccidum	O	X	..	..	..	..	..
	Clematis microphylla	O	X	..	X	X	..	..
	Psoralea tenax	F	X	..	..	..	..	..
	Psoralea eriantha	O	X	..	..	..	..	..
	Swainsona microphylla	O	X	..	..	..	..	..
	Swainsona procumbens	O	X	..	..	..	..	..
	Swainsona phacoides	O	X	..	..	..	..	..
	Swainsona reticulata	R	X	..	..	..	..	..
	Swainsona Greyana	R	X	..	..	..	..	..
	Lotus australis	O	X	..	..	..	..	..
	Verbena officinalis	F	X	..	..	..	..	..
	Ajuga australis	O	X	..	X	..	..	..
	Wahlenbergia gracilis	F	X	X	X	..	..	..
	Goodenia subintegra	F	X	..	..	..	..	..
	Goodenia glauca	O	X	..	..	..	..	..
	Goodenia heteromera	F	X	..	..	..	..	..
	Brachycome calocarpa	F	X	..	..	..	..	..
	Brachycome pachyptera	O	X	X	X	..	..	..
	Brachycome graminea	O	X	..	..	..	..	..
	Calotis cuneifolia	P	X	..	..	..	..	..
	Calotis anthemoides	O	X	..	..	..	..	..
	Calotis scapigera	F	X	..	..	..	..	..
	Vittadinia triloba	P	X	X	X	X	X	..
	Minuria integerrima	F	X	..	..	..	..	..
	Craspedia uniflora	O	X	..	X	..	..	..
	Craspedia pleiocephala	O	X	..	X	..	..	..
	Helipterum corymbiflorum	F	X	..	X	..	..	X
	Convolvulus erubescens	O	X	..	..	..	..	..
	Morgania glabra	P	X	..	..	..	..	..
	Halorrhagis heterophylla	P	X	..	..	..	..	..
	Calocephalus Sonderi	O	X	..	X	X	..	X
	Teucrium racemosum	F	X	..	..	..	..	..
	Centipeda Cunninghamii	P	X	..	..	..	..	..
	Centipeda minima	O	X	..	..	..	..	..
	Mentha australis	F	X	..	..	..	..	..
	Mentha satureioides	P	X	..	..	..	..	..
	Lavatera plebeja	O	X	..	..	..	..	..
	Trichinium alopecuroideum	O	X	..	..	..	..	..
	Polygonum lapathifolium	O	X	..	..	..	..	..
	Solanum nigrum	F	X	..	..	..	..	..

TABLE 2—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Solanum lacunarium*	R	X	..	..	..	..	..
	Calostemma purpureum	R	X	..	..	..	..	..
	Rumex crystallinus	O	X	..	..	..	..	..
	Alternanthera nodiflora	R	X	..	..	..	..	..
	Alternanthera denticulata	F	X	..	..	..	..	..
	Mesembrianthemum australe	F	X	..	..	..	..	X
	Glinus spergula	F	X	..	..	..	..	..
	Glinus lotoides	F	X	..	..	..	..	..
	Spergularia rubra	F	X	..	..	..	..	..
	Myosurus minimus	O	X	..	..	..	..	..
	Ranunculus parviflorus var *glabrescens* ..	O	X	..	..	..	..	..
	Blennodia cardaminoides	O	X	..	..	..	..	..
	Lepidium hyssopifolium	F	X	..	..	..	..	..
	Lepidium papillosum	F	X	..	..	..	..	..
	Lepidium fasciculatum	O	X	..	..	..	..	..
	Cardamine laciniata	O	X	..	..	..	..	..
	Crassula colorata	O	X	..	X	X	..	..
	Zygophyllum ammophilum	O	X	..	..	..	..	..
	Euphorbia Drummondii	F	X	X	X	..	..	..
	Plantago varia	F	X	..	..	..	..	X
	Asperula wimmerana	O	X	..	..	..	..	..
	Asperula gemella	R	X	..	..	..	..	..
	Leptorhynchus panaetioides	O	X	..	..	..	..	..
	Eclipta platyglossa	O	X	..	..	..	..	..
	Oxalis corniculata	F	X	X	X	X	..	..
	Abutilon Theophrasti	R	X	..	..	..	..	..
	Melothria micrantha	O	X	..	X	..	..	..
	Phyllanthus lacunarius	R	X	..	..	..	..	..
	Ammannia multiflora	O	X	..	..	..	..	..
	Heliotropium europaeum	F	X	..	..	..	..	..
	Heliotropium curassavicum	O	X	..	..	..	..	..
4	*Marsilia Drummondii*	F	X	..	..	..	..	..
	Cyperus vaginatus	F	X	..	..	..	..	..
	Cyperus Gunnii	F	X	..	..	..	..	..
	Cyperus difformis	F	X	..	..	..	..	..
	Juncus pauciflorus	F	X	..	..	..	..	..
	Juncus bufonius	O	X	..	..	..	..	..
	Limnanthemum crenatum	O	X	..	..	..	..	..
	Loranthus Preissii	O	X	X	X	X	..	..

TABLE 2—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
4	*Loranthus pendulus*	R	X	..	..	..	..	..
	Loranthus Miquelii	F	X	X	X	X	..	..
	Loranthus exocarpi	O	X	X	X	X	..	..
	Pollinia fulva	O	X					
	Poa caespitosa	O	X	..	..	..	..	..
	Paspalidium jubiflorum	P	X	..	..	..	..	..
	Panicum decompositum	O	X	..	..	..	..	..
	Panicum effusum	O	X	..	..	..	..	..
	Digitaria divaricatissima	O	X	..	..	..	..	..
	Eragrostis Dielsii	F	X	..	..	..	..	..
	Eragrostis falcata	F	X	..	..	..	..	..
	Eragrostis Brownii	F	X	..	..	..	..	..
	Chloris truncata	O	X	..	..	..	..	..
	Chloris acicularis	F	X	..	..	..	..	..
	Chamaeraphis spinescens	P	X	..	..	..	..	..
	Amphibromus nervosus	F	X	X	X	X	..	X
	Salsola Kali	F	X	X	X	X	..	X
	Atriplex Muelleri	O	X	..	..	..	..	..
	Atriplex leptocarpum	F	X	..	..	..	..	..
	Atriplex semibaccatum	F	X	..	..	..	..	..
	Bassia uniflora	F	X	X	X	X	..	..
	Bassia tricuspis	F	X	..	..	..	..	X
	Bassia quinquecuspis	O	X	..	..	..	..	X
	Kochia tomentosa	F	X	..	..	..	..	X
	Kochia villosa	O	X	..	..	..	..	..
	Sporobolus virginicus	O	X	..	..	..	..	..
	Alopecurus geniculatus	O	X	..	..	..	..	..
	Calamagrostis filiformis	O	X	..	..	..	..	..
	Aristida arenaria	R	X	..	..	..	..	..
	Phragmites communis	F	X	..	..	..	..	..
	Typha angustifolia	F	X	..	..	..	..	..
	Fimbristylis squarrosa	O	X	..	..	..	..	..
	Scirpus inundatus	O	X	..	..	..	..	..
	Chenopodium atriplicinum	O	X	..	..	..	..	..
	Chenopodium album	O	X	..	..	..	..	..
	Chenolea brachyptera	F	X	..	X	..	..	X
	Chenolea stelligera	O	X	..	..	..	..	..
	Rhagodia nutans	O	X	..	X	X	..	..
	Rhagodia hastata	O	X	X	X	..	..	..
	Rhagodia Gaudichaudiana	O	X	..	X	..	..	..
	Threlkeldia salsuginosa	F	X	..	X	..	..	X

TABLE 2—*continued.*

Group No.	Species.		1.	2.	3.	4.	5.	6.
4	*Cuscuta tasmanica*	O	X	..	..	..	..	..
	Jussieua diffusa	F	X	..	..	..	..	..
	Myriophyllum verrucosum	F	X	..	..	..	..	..
	Myriophyllum propinquum	F	X	..	..	..	..	..
	Azolla filiculoides	F	X	..	..	..	..	..
	Damasonium minus	O	X	..	..	..	..	..
	Valisneria spiralis	O	X	..	..	..	..	..
	Ottelia ovalifolia	F	X	..	..	..	..	..
	Potamogeton sulcatus	F	X	..	..	..	..	..

SOILS SUPPORTING VEGETATION TYPE 1

SOIL DIVISION 1.

Soil Group 1.

Soil Types 1, 2, 3, 4, 5A, 5B, 6 and 7.

The soils of Group 1 are confined to areas adjacent to the Murray River and come within the zone of periodical inundation. The lowest levels are flooded by the annual rise of the river; the highest areas are reached only at periods of extreme flooding, e.g., in 1870, 1917, and 1931. The high flood limit is distinguished by the change of vegetation and soil colour. *Eucalyptus bicolor* does not extend to areas above the influence of periodical flood waters, and the soil colour changes from the typical grey of the Box flats to the red-brown shades of the Pine and Mallee associations (Soil Groups 2, 3, 4 and 5).

The origin of these soils is responsible for the variation exhibited in the profile. Soils gathered from the headwaters of the river, together with soils collected on its progress downstream, are re-deposited and so form the soils of Group 1.

The older soils of this group are alkaline in reaction, but soil acidity is frequent in the soils of more recent deposition. The acid reaction probably is due to transportation of soils from the Murray headwaters where the soil reaction is notably acid.

Characteristic features of this soil group are the prevailing greyness in colour, the general heaviness of texture, and the moderate amount of calcium carbonate present when compared with other soils, particularly those of Group 3.

The various soil types are summarized in Table 3.

The lighest soils are represented by Soil Types 1 and 2 and occupy the highest levels. The dominating feature of Type 1 is the amount of sand, which sometimes extends from the surface to a depth of about 42 inches. More commonly, a green-grey sandy clay is met with at about 28 inches, golden sand pockets are present, and the sand fraction increases near 36 inches. Below this, the sandy clay continues with increasing sand pockets which change to a red-brown colour at 60 inches, a slight amount of lime* appearing at 54 inches. (Fig. 1.)

Type 2 resembles Soil Type 14A discussed by Marshall and King (2).

Types 3, 4, 5, 5A and 5B are distinctly heavy soils and are not dissimilar to Soil Types 9 and 9A of Taylor and Penman (3), and Nyah Clay Loam of Taylor, Penman, Marshall and Leeper (4).

Type 5 is representative of the heaviest soil type occurring at levels beyond the annual flood limits of the Murray River. The colour is grey to light-grey throughout, and the surface texture marks this type as a distinctly heavy surface soil. The surface horizon is a heavy clay to a depth of 8 inches, changing to a medium clay with slight lime. At 15 inches a further fall in texture takes place and continues to about 48 inches, but the lime increases to a medium amount. This horizon is classed as a light clay. Between 48 inches and 60 inches a heavy clay occurs and small rubble is present, but slight in quantity, the lime decreasing to a few well-distributed pockets. (Fig. 2.)

A reaction in the vicinity of pH6 for the surface horizon, and pH6·5 at 60 inches, denotes a type of more recent origin than the types already mentioned, and is typical of soils of the lower levels supporting *Eucalyptus rostrata*. Soil Type 6 is characteristic of low Red Gum areas, and comes within the zone of annual inundation from the rise of the Murray River. The surface often exhibits a "crab-holey" formation; the texture is a heavy clay of a uniform grey colour throughout, and crystalline gypsum occurs in small pockets below 48 inches, but is generally not pronounced. This type is the heaviest found in Soil Group 1 (Fig. 3). Examination of the "puff" and "hollow" in "crab-holey" areas reveals the presence of small nodular limestone immediately beneath the "puff" but not below the "hollow". This feature of "crab-holey" soils has been discussed by Prescott (5).

Soil Type 7 occupies low levels. The surface soil reaction is often quite acid, pH5·5 being a frequent value, with a corresponding low value of pH6 at 60 inches. This type supports *Muehlenbeckia Cunninghamii*. While not so heavy as Type 6, the profile shows a textural surface difference of a medium clay to about 9 inches before the heavy clay is reached. Appreciable amounts of silt are present throughout. This type exhibits little differentiation in the profile, the presence of small amounts of crystalline gypsum below 24 inches being the only feature. Extreme cracking on drying out is characteristic.

* In the Soil Sections of this work, the term "lime" is used only for calcium carbonate when it appears in the soft form.

Table 3.—Summary of Soil Type Descriptions.

Division 1.—*Group* 1.

Soil Group.	Soil Type.	Surface.	Subsoil.	Deep Subsoil.	Remarks.
1	1	Grey sand 0–9″	Light-grey sand 9–28″	Green-grey sandy clay with golden sand pockets 28–36″. Green-grey sandy clay with increasing sand pockets, slight lime 36–60″	High Box land
1	2	Grey to light grey sand 0–15″	Green-grey sandy clay with patches of yellow sand. Few specks of lime 15–29″	Light-grey sandy clay with much small rubble and lime 29–48″. Light-grey sand, much lime, rubble decreasing 48–60″	High Box land
1	3	Dark-grey loam 0–6″	Grey clay loam with some specks lime 6–14″. Light-grey light clay, much lime 14–37″	Light-grey light clay, much lime and some small rubble 37–52″. Grey-brown sandy clay. No lime 52–60″	Box flat
1	4	Grey to light grey sand 0–7″	Dark-grey light clay 7–16″	Dark-grey medium clay 16–31″. Light-grey heavy clay, much lime and small rubble 31–60″	Box flat
1	5	Grey heavy clay 0–8″	Grey medium clay. Slight lime 8–15″	Light-grey light clay, lime increasing 15–48″. Light-grey heavy clay, some pockets lime, slight amount of small rubble 48–60″	Box flat
1	5A	Grey silty clay loam 0–3″	Grey light clay, slight lime and small rubble 3–16″. Grey heavy clay, few pockets lime 16–30″	Grey-brown medium clay, few pockets of lime, medium amount of small rubble 30–45″. Grey-brown light clay, slight lime. No rubble 45–60″	Box flat
1	5B	Light-grey clay 0–6″	Light-grey light clay with slight lime 6–24″	Light-grey light clay with lime increasing 24–52″. Yellow sandy clay, slight small rubble 52–60″	Box flat
1	6	Grey heavy clay 0–6″	Grey heavy clay 6–36″	Grey heavy clay 36–48″. Grey heavy clay with crystal gypsum but not pronounced 48–60″	Low land supporting *Eucalyptus rostrata*
1	7	Light-grey to grey silty medium clay 0–9″	Grey silty heavy clay 9–24″	Grey-brown silty heavy clay with occasional small pockets of crystal gypsum 24–60″	Low land supporting *Muehlenbeckia Cunninghamii*

TYPE 1.

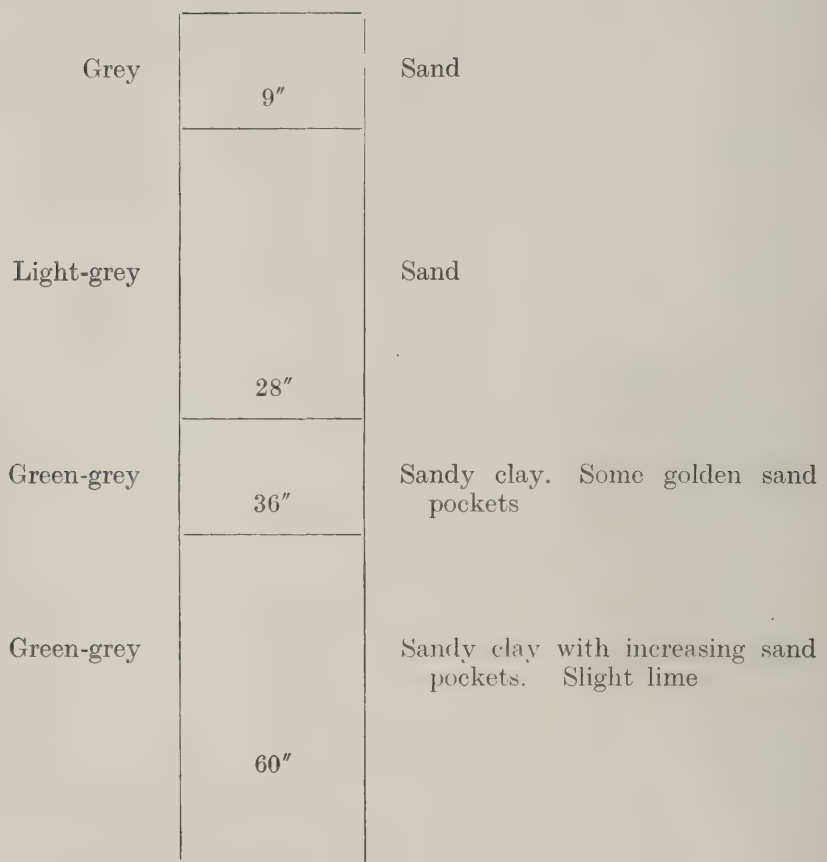

Grey
9″
Sand
Light-grey
Sand
28″
Green-grey
36″
Sandy clay. Some golden sand pockets
Green-grey
Sandy clay with increasing sand pockets. Slight lime
60″

Fig. 1.

TYPE 5.

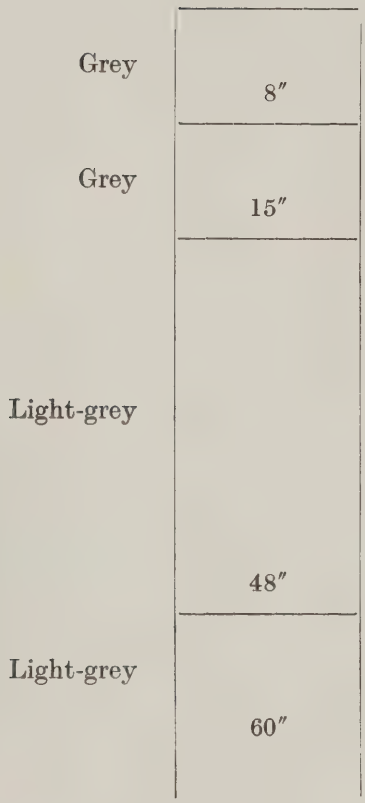

Grey
8″
Heavy clay
Grey
15″
Medium clay. Slight lime
Light-grey
Light clay with lime increasing to a medium amount
48″
Light-grey
Heavy clay. Some well-distributed pockets of lime. Slight small rubble
60″

Fig. 2.

TYPE 6.

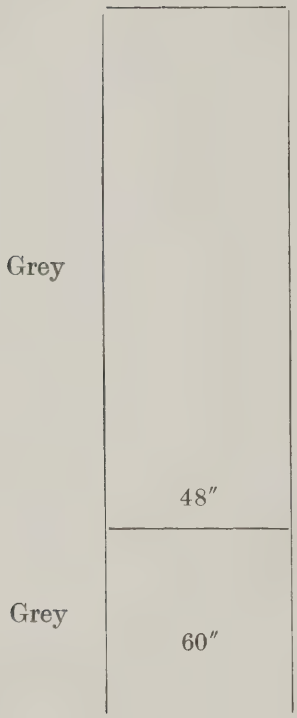


Fig. 3.

VEGETATION TYPE 2

Pine–Belar–Buloke Areas.

Vegetation Type 2 comprises extensive areas carrying principally *Callitris spp.* and *Casuarina spp.* with scattered *Myoporum platycarpum.* There is a lower canopy of various small trees and shrubs. Mixed with the Pine–Belar–Buloke belts, patches of Tall Mallee (*Eucalyptus oleosa–Eucalyptus gracilis–Eucalyptus incrassata*) occur. These Mallee areas are similar to much larger Mallee areas which will be dealt with separately (Vegetation Type 3).

The chief species of undergrowth to Pine–Belar–Buloke vegetation are *Pittosporum phillyreoides, Fusanus acuminatus, Hakea vittata, Hakea leucoptera, Eremophila oppositifolia, Eremophila maculata, Eremophila glabra, Exocarpus aphylla, Grevillea Huegelii, Beyeria Leschenaultii, Templetonia egena, Acacia colletioides, Acacia Oswaldii, Acacia ligulata, Acacia obliqua, Acacia sclerophylla, Heterodendron oleifolium, Scaevola spinescens, Olearia Muelleri.*

In this area, Pine (chiefly *Callitris robusta*) and Belar (*Casuarina lepidophloia*) do not usually appear as species mixed in the same area but form stands solely of the one genus—that is to say, they mingle only where the change from one species to another takes place.

Casuarina lepidophloia (Belar)—Yarrara.

Certain species are noticed which also occur in the Box flat country, viz. :— *Acacia Oswaldii, Pittosporum phillyreoides, Templetonia egena, Eremophila maculata* and *Heterodendron oleifolium.* Although *Casuarina lepidophloia* and *Callitris robusta* have been observed in Box flat country, the occurrence is extremely rare and does not indicate any soil similarity, but rather an instance of adaptation. These trees are located on high Box land which is rarely flooded and then is only submerged for a short period to a depth of several inches.

The presence of certain species in Box flats points to the fact that these species were first confined to drier situations and different soil conditions. If these species

existed equally in both areas in the first place, there is no reason why they should now be exceedingly numerous in dry areas, and only occasionally met in close association with *Eucalyptus bicolor* and kindred plants rigidly confined to Box flats.

On the other hand, it would seem that *Eremophila maculata* is much more at home in Box flat areas than dry areas. It is quite common on Box flats and vigorous in growth. Away from Box flats it is encountered less often and assumes a low ungraceful habit.

Trees of *Pittosporum phillyreoides*, *Fusanus acuminatus* and *Templetonia egena* in Box flats do not show any greater benefit from the extra moisture which they derive from this situation and do not attain larger dimensions thereby.

Again, *Acacia Oswaldii* appears both on Box flat and Pine–Belar country as well as in Mallee areas, and association with *Eucalyptus bicolor* has not proved to be of advantage. *Acacia Victoriae* growing on Box flats and Tall Mallee areas appears to be equally at home on either area.

Belar patches generally do not carry the variety of smaller plants that are usually met with under *Callitris*. The absence of grasses is particularly marked and no doubt this is due to the enormous amount of surface-feeding roots put out by *Casuarina lepidophloia*. These lateral roots are only a few inches under the surface and frequently protrude from the soil.

Curiously enough, the only plants of *Pterostylis rufa* in this part have been found under these trees. This orchid is rare and only appears in very good seasons.

Geijera parviflora, recorded as rare in north-west Victoria (1), seems to be extinct. Considerable search has not revealed its presence in Victoria although isolated trees can still be found in Vegetation Type 2 areas in New South Wales, the nearest locality being about 12 miles north-east of Mildura.

Regeneration of Murray Pine.

Acacia aneura, doubtfully recorded for Victoria (1), definitely does not occur in this State. The place nearest to Victoria in which it occurs, in association with Belar, is Oak Tanks in New South Wales, some 18 miles to the north-east of Mildura.

Vegetation Type 2.

A typical stand of *Callitris robusta* on level ground.

Typical Buloke (*Casuarina Luechmannii*).

TABLE 4.—VEGETATION TYPE 2.

(*Pine–Belar–Buloke Areas.*)

Group 1—Trees	Prominent (P)
Group 2—Shrubs and Semi Shrubs	Frequent (F)
Group 3—Small Plants often Seasonal	Occasional (O)
Group 4—" Others "	Rare (R)

" x " indicates occurrence.

Group No.	Species.		Occurrence in Vegetation Types—					
			1.	2.	3.	4.	5.	6.
1	*Callitris robusta*	P	x	x	..	..	..	..
	Callitris propinqua	P	..	x	..	..	..	..
	Casuarina lepidophloia	P	x	x	..	..	..	..
	Casuarina Luehmanii	O	..	x	..	..	..	..
	Hakea vittata	O	..	x	x	x	..	..
	Hakea leucoptera	P	..	x	x	x	..	x
	Fusanus acuminatus	O	x	x	x	..	..	..
	Heterodendron oleifolium	P	x	x	x	..	..	..
	Eremophila oppositifolia	F	..	x	..	..	..	..
	Myoporum platycarpum	P	..	x	x	x	..	..
	Acacia Oswaldii	F	x	x	x	x	..	..
2	*Grevillea Huegelii*	F	..	x	x	..	..	..
	Exocarpus aphylla	F	..	x	x	..	..	..
	Marsdenia australis	R	..	x	x	x	..	..
	Lepidium leptopetalum	O	..	x	x	..	..	..
	Cassia eremophila	F	..	x	x	..	..	..
	Cassia Sturtii	F	..	x	x	..	..	..
	Acacia ligulata	F	..	x	..	x	x	..
	Acacia obliqua	F	..	x	x	x	..	..
	Acacia hakeoides	F	..	x	x	x	..	..
	Acacia colletioides	F	..	x	x	x	..	..
	Templetonia egena	O	x	x	..	..	..	..
	Nitraria Schoberi	O	..	x	x	..	..	x
	Beyeria Leschenaultii	P	..	x	..	..	..	..
	Dodonaea attenuata	P	..	x	x	..	..	..
	Eremophila glabra	F	..	x	x	x	..	..
	Eremophila maculata	O	x	x	x	..	..	..
	Eremophila longifolia	O	..	x	x	..	..	..
	Olearia Muelleri	F	..	x	x	x	..	..
	Olearia decurrens	O	..	x	..	..	..	..
	Cassinia arcuata	R	..	x	..	..	..	..
	Jasminum lineare	R	..	x	..	..	..	..
	Olearia pimeleoides	O	..	x	x	..	..	..
	Scaevola spinescens	O	..	x	x	..	..	..

TABLE 4—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Anguillaria dioica*	O	..	X	..	..	..	..
	Pterostylis rufa	R	..	X	..	..	..	..
	Blennodia lasiocarpa	F	..	X	..	..	..	..
	Wahlenbergia gracilis	F	X	X	X	..	..	..
	Brachycome ciliaris	O	..	X	..	..	..	..
	Vittadinia triloba	F	X	X	X	X	X	..
	Helipterum polygalifolium	O	..	X	..	..	..	..
	Helipterum variabile	O	..	X	..	..	..	..
	Millotia tenuifolia	O	..	X	X	..	..	..
	Erythraea spicata	O	..	X	..	..	..	..
	Hutchinsia procumbens	O	..	X	X	..	..	X
	Parietaria debilis	O	..	X	X	..	..	..
	Scleranthus minusculus	R	..	X	X	X	..	..
4	*Cassytha melantha*	F	..	X	X	X	X	..
	Kochia pyramidata	O	..	X	X	X	..	X
	Stipa spp	P	..	X	X	X	X	X
	Danthonia spp	F	X	X	X	X	..	..
	Loranthus Preissii	F	X	X	X	X	..	..
	Loranthus Miquelii	F	X	X	X	X	..	..
	Loranthus linophyllus	O	..	X	..	..	..	..
	Loranthus miraculosus var *Boormannii* ..	F	..	X	..	..	..	..
	Eragrostis setifolia	O	..	X	X	..	..	..
	Bassia sclerolaenoides	O	..	X	X	X	..	..
	Bassia parviflora	O	..	X	X	X	..	..
	Chenolea pentagona	O	..	X	X	X	..	..
	Atriplex limbatum	O	..	X	X	..	..	X

SOILS SUPPORTING VEGETATION TYPE 2

Soil Division 2.

Soil Group 2.

Soil Types 8, 9, 10, 11, and 12.

In appearance the soils show less variation than the soils of Group 1, and are distinguished from that group by the following features :—

(*a*) The red-brown colour (sometimes light-brown to brown).

(*b*) The presence of marked quantities of calcium carbonate in the soft, rough, or nodular forms in all types with the exception of Type 8, which is representative of the highest sand ridges.

(*c*) They are not as heavy in general average texture.

The reaction is alkaline.

Topographically, the soils of this group are divisible into four regions, namely the higher sand ridges, the lesser sand ridges, the gently undulating rises, and the flat land between the undulating rises and lesser sand ridges. The parallel sand ridges running approximately east and west are evidence of aeolian origin.

Type 8 is typical of the higher sand ridges and supports a predominating growth of *Callitris robusta*. The profile is characterized by the uniformity of sand throughout and the absence of lime. Occasionally, a sandy loam occurs below a depth of 36 inches, with much lime and varying amounts of rubble. This type has been named Murray Sand and dealt with by Taylor and England (6). The Murray Sand appears to belong to the lesser sand ridge formation, becoming an intermediate type between Type 8 of the higher sand ridges and Type 9 of elevations below the more prominent ridge structure.

Extensive areas of gently undulating land form the main Native Pine belts. The predominating growth is *Callitris robusta*, which thrives on low rises and flats alike. Type 9 is typical of the low rises and texturally is a transitional type from the Murray Sand to Type 10. The surface horizon is a red-brown sandy loam. At 14 inches slight lime occurs, and increasing with depth becomes very pronounced at about 46 inches where the sandy loam overlies a red-brown sandy clay loam. The sandy clay loam horizon contains much lime in the soft form.

Types 10 and 11 exhibit an affinity to the Tatchera Soil Type (Tatchera Sand and Tatchera Sandy Loam) of Taylor, Penman, Marshall and Leeper (4). Type 10 supports *Callitris robusta* mainly, while Type 11 is typical of areas where *Casuarina lepidophloia* predominates, both soil types forming the so-called " flats " between the lesser sand ridges and exhibiting a heavier texture than Type 9. The surface horizon of Type 10 is a shallow sandy loam overlying a red-brown loam with slight lime. At 18 inches the texture changes to a sandy clay loam with increasing lime, and some small rubble is present. A light clay with much lime, but without rubble, constitutes the deep subsoil (Fig. 4).

That Belar (*Casuarina lepidophloia*) prefers a heavier soil is indicated by the increase in clay shown in the profile of Type 11, which is representative of the soils of the Belar flats. Usually this type is noted for the presence of lime and nodular limestone in quantity. Although lime in the soft form is always found in appreciable

amounts, nodular limestone is spasmodic or only slight in quantity. The surface horizon varies from a red-brown sandy loam to a loam, and overlies a clay loam with moderate lime. At about 12 inches below the surface a light clay with much lime and some nodular limestone is encountered, and continues to a depth of about 36 inches below the surface. The light clay overlies a medium clay. Much lime is distributed throughout the horizon, and nodular limestone occurs in varying amounts. (Fig. 5.)

Type 12 is characteristic of small open "flats" occurring in soils of Types 10 and 11. These areas are chiefly occupied by grasses such as *Stipa spp.* and *Danthonia spp.* Type 12 is not unlike the Vinifera Loam Type described by Taylor, Penman, Marshall and Leeper (4), and is the heaviest type found in the soils of Group 2. With the exception of the brown loam surface horizon, lime is present in large amounts, especially in the subsoil medium clay, but nodular limestone is usually not pronounced. The lack of any great depth of light surface soils may be responsible for the absence of tree growth, as the surface would be conducive to the formation of a shallow root system. Such a system is a distinct disadvantage in a climate of small rainfall and prolonged periods of drought and heat. The soils of Group 2 are summarized in Table 5.

TABLE 5.—SUMMARY OF SOIL TYPE DESCRIPTIONS.

Division 2.—Group 2.

Soil Group.	Soil Type.	Surface.	Subsoil.	Deep Subsoil.	Remarks.
2	8	Light-brown sand	Light-brown sand ..	Light-brown sand	Murray Pine, higher sand ridges
2	9	Red-brown sandy loam 0–14″	Red-brown sandy loam, slight lime at 14″ and increasing 14-46″	Red-brown sandy clay loam with considerable lime 46–60″	Murray Pine, gentle rises
2	10	Red-brown sandy loam 0–6″	Red-brown loam with slight lime 6–18″	Red-brown sandy clay loam, lime increasing with some small rubble 18–28″. Red-brown light clay with much lime. No rubble 28–60″	Murray Pine flats
2	11	Red-brown loam 0–7″	Red-brown clay loam with moderate amount of lime 7–12″	Red-brown light clay with much lime and slight nodular limestone 12–36″. Red-brown medium clay with much lime and slight nodular limestone 36–60″	Belar flats
2	12	Brown loam 0–8″	Light-brown light clay with medium lime 8–15″	Light-brown medium clay with considerable lime 15–36″. Light brown medium clay, some lime and nodular limestone 36–60″	Open flats in Pine – Belar areas. Vegetation chiefly *Stipa spp.*

TYPE 10.

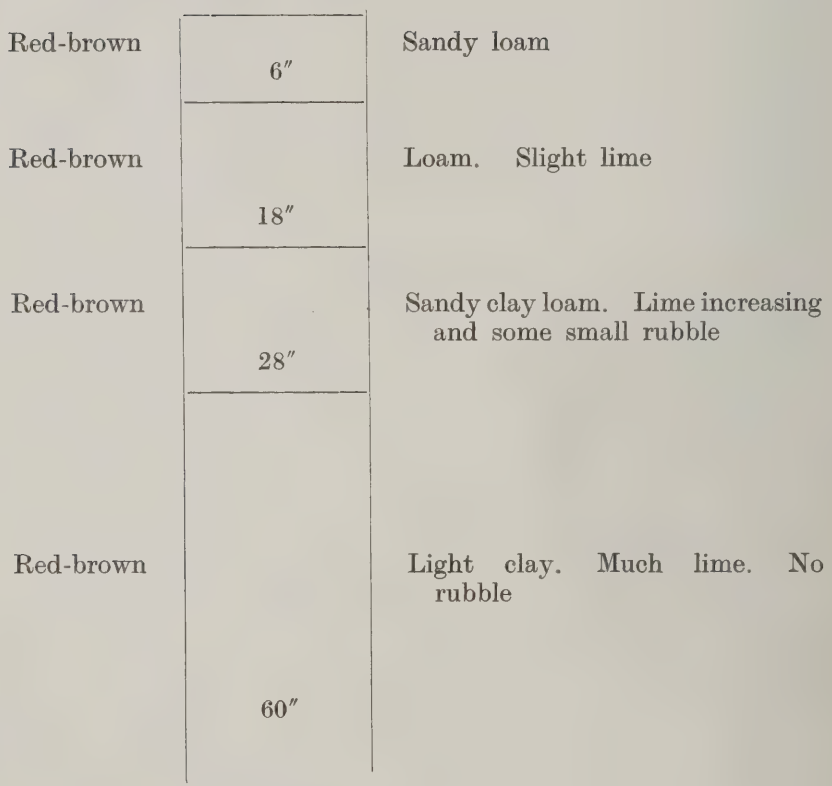

Red-brown
6″
Sandy loam
Red-brown
Loam. Slight lime
18″
Red-brown
Sandy clay loam. Lime increasing and some small rubble
28″
Red-brown
Light clay. Much lime. No rubble
60″

Fig. 4.

TYPE 11.

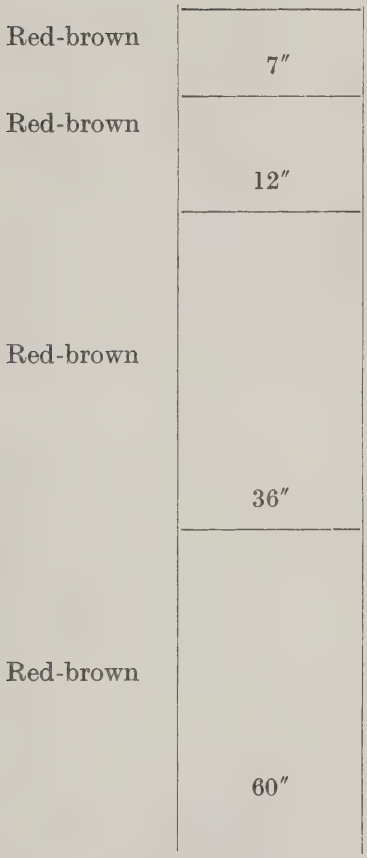

Red-brown
7″
Loam
Red-brown
12″
Clay loam. Moderate lime
Red-brown
36″
Light clay. Much lime, slight nodular limestone
Red-brown
60″
Medium clay. Much lime, slight nodular limestone

Fig. 5.

VEGETATION TYPE 3

Tall Mallee Areas.

These tracts of country are situated mainly in the midland sections of the north-west, bounded on the north by the Box Flat areas and on the south by the Small Mallee areas approaching the dry arid sandhill section. Miniature areas occur scattered through Pine–Belar–Buloke areas, and also on high land within the Salt Lake areas and Copi rises. (See Vegetation Map.)

The following species of *Eucalyptus* comprise the main overhead flora :— *Eucalyptus oleosa*, *Eucalyptus gracilis*, *Eucalyptus incrassata*, *Eucalyptus dumosa* and *Eucalyptus viridis*. Considerable variation is observed in these trees, and the transit between the species occupies several phases. Species true to the type, however, are fairly readily located, and "in-betweens" can only be judged according to their nearness to any particular species. It is difficult at times to place some variations under any one species. Associated with these *Myoporum platycarpum*, *Fusanus acuminatus*, *Heterodendron oleifolium*, *Hakea vittata*, *Hakea leucoptera*, and *Pittosporum phillyreoides* form the smaller tree-like growth.

This type of country carries a great variety of shrub growths and smaller plants, but fewer shrubs than the Small Mallee areas and less smaller seasonal plants by species than Box flats. The *Acacia* genus is well represented, as is also *Eremophila* and *Olearia*. The *Compositae* family is to the fore among the smaller plants.

As in Box flats and Pine–Belar–Buloke areas, the occurrence is noted of *Pittosporum phillyreoides*, *Heterodendron oleifolium* and *Acacia Oswaldii* amongst the larger growths. It would appear, however, that *Acacia Oswaldii* is the only one of these that occurs frequently in the three types. *Pittosporum phillyreoides* and, in particular, *Heterodendron oleifolium* are comparatively rare in Box Flat areas, and while *Heterodendron oleifolium* is more frequent in Pine–Belar–Buloke areas than in Mallee areas, *Pittosporum phillyreoides* appears equally in both Pine–Belar–Buloke and Tall Mallee patches. This clearly indicates that some plants can more readily adapt themselves to different soil conditions :—

(*a*) *Acacia Oswaldii* commonly occurs on Box Flat, Pine–Belar–Buloke, Tall Mallee, and Small Mallee areas. However, it does not extend on to the arid sandhill areas.

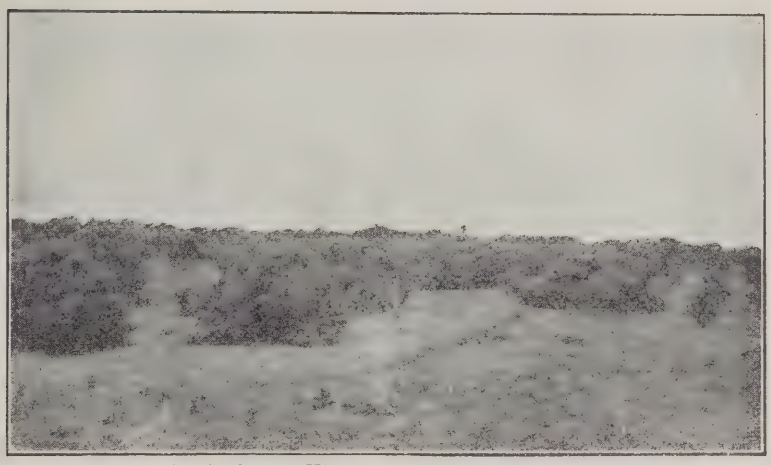
(*b*) *Pittosporum phillyreoides* commonly appears in Pine–Belar–Buloke areas and less frequently in Small Mallee areas. It is rare on Box flats.

(*c*) *Heterodendron oleifolium* is definitely more comfortable in Pine–Belar–Buloke patches, but it also readily occurs in Tall Mallee areas. It is not found in Small Mallee areas as a rule and is rare on Box flats.

On the other hand, it is noticeable that *Fusanus acuminatus* and *Myoporum platycarpum* are not so numerous in Tall Mallee areas as in Pine–Belar–Buloke areas, and do not reach such large dimensions. This is also true of *Exocarpus aphylla*, *Hakea vittata* and *Hakea leucoptera*

Vegetation Type 3.

Tall Mallee (*Eucalyptus oleosa*).



A blue-bush flat. The species is *Kochia pyramidata*.

Vegetation Type 5.

Sandhills in the Stunted Mallee Areas. *E. viridis and E. incrassata. Leptospermum coriaceum* is present and the leaning bush in the centre is *Exocarpus spartea.*

Callitris verrucosa—Scrub Pine. The Mallee is *E. incrassata. Triodia irritans* is present.

Reverting to the shrub growths, *Grevillea Huegelii*, *Cassia eremophila*, *Cassia Sturtii*, *Dodonaea attenuata*, *Acacia obliqua*, *Acacia microcarpa*, *Acacia hakeoides*, *Acacia colletioides*, *Acacia rigens*, *Acacia homalophylla*, *Acacia sclerophylla*, *Eremophila glabra*, *Eremophila maculata*, *Eremophila scoparia*, *Eremophila longifolia*, *Eremophila Sturtii*, *Olearia magniflora*, *Olearia pimeleoides*, *Olearia Muelleri*, *Halgania cyanea*, and *Westringia rigida* occur commonly, with the exception of *Eremophila Sturtii* and *Eremophila scoparia*. Owing to invasions by rabbits which remove the bark from the twining stems near the ground, *Marsdenia australis* is rapidly becoming rarer. Many of these shrubs also occur in Small Mallee areas. *Lepidium leptopetalum* is fairly rare, as is also *Blennodia trisecta*. The only one of these shrubs occurring in Box Flat areas is *Eremophila maculata*. Among the smaller plants *Clematis microphylla*, *Ajuga australis*, *Wahlenbergia gracilis*, *Vittadinia triloba*, *Craspedia uniflora*, *Craspedia pleiocephala*, *Helipterum corymbiflorum*, and *Gnaphalium luteo-album* also appear in Box Flat areas. The only two of these plants observed in Pine–Belar–Buloke areas are *Wahlenbergia gracilis* and *Vittadinia triloba*. This shows that Tall Mallee areas are much more suited to the growth of this type of vegetation than are the Pine–Belar–Buloke areas. The family *Compositae* is largely represented, at least fourteen genera commonly being present.

Eucalyptus uncinata and *Eucalyptus polybractea* have not extended so far to the north.

VEGETATION TYPE 4

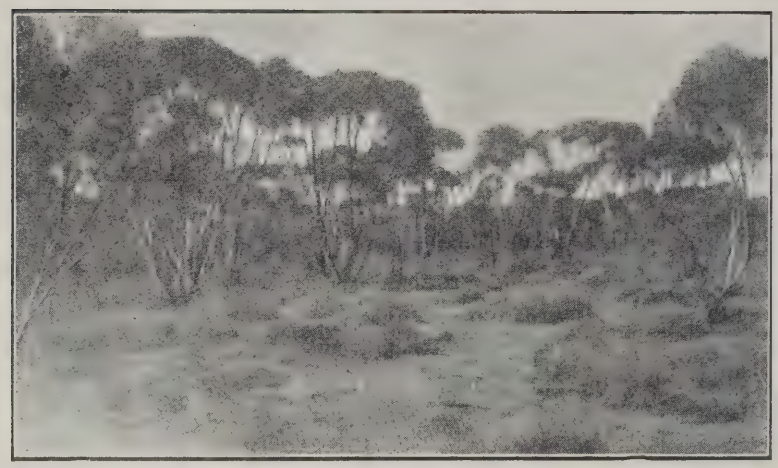
Small Mallee Areas.

The main areas of this type of vegetation are to be found forming a half-way type between the Tall Mallee areas and the Stunted Mallee areas (Arid Sands). The soil is very sandy and the appearance of Porcupine Grass (*Triodia irritans*) is general. This class of country occupies a large portion of the northern section of the unallotted areas which lie south of the selected blocks in the County of Millewa. Occasional patches of good soils appear spasmodically in the northern portion, but to the south approaching the arid sand hills the area is fairly uniform. These good soil patches support Vegetation Types 2 or 3.

The trees occurring are constantly smaller than those to be found in Tall Mallee areas, and certain new species appear. The shrub growth and smaller plants show considerable variation in species and differ somewhat from the usual shrubs and small plants found on Tall Mallee areas. The occurrence of *Eucalyptus incrassata*, *Eucalyptus dumosa*, *Eucalyptus oleosa*, and *Eucalyptus viridis* is to be expected. These trees form the predominant vegetation. *Hakea vittata* and *Hakea leucoptera* appear scattered throughout, and new species in *Codonocarpus cotinifolius*, *Exocarpus spartea*, *Fusanus persicarius* and *Callitris verrucosa* come in. These belts are marked by the total absence of *Myoporum platycarpum* in the tree stage. This plant, when occurring, is reduced to a tall shrub with several stems often arising from the butt.

Generally speaking, the flora to be found in Small Mallee areas is more closely akin to that found in Tall Mallee areas than that of any other vegetation type. The occurrence of *Exocarpus spartea* and *Grevillea pterosperma* shows an inclination of these arid soil plants to extend to comparatively better soils.

Vegetation Type 4.



Small Mallee type. The species in the photograph is *Eucalyptus oleosa*. The grass is *Triodia irritans*.

Vegetation Type 5.

Stunted Mallee type. The eucalypt species are *E. oleosa* and *E. viridis*. Porcupine grass (*Triodia irritans*) is abundant.

Here again *Acacia Oswaldii* occurs, but in a reduced state. It has already been shown that this Acacia appears on Box Flat areas, Pine–Belar–Buloke areas, and Tall Mallee areas. With *Clematis microphylla* and *Vittadinia triloba*, *Acacia Oswaldii* has appeared in Box Flat areas, Pine–Belar areas, Tall Mallee areas, and Small Mallee areas.

Other new species occur, namely, *Muehlenbeckia diclina*, *Eutaxia microphylla*, *Phebalium glandulosum*, *Bertya Mitchellii*, *Beyeria opaca*, *Dodonaea bursariifolia*, *Dodonaea stenozyga*, *Plagianthus Berthae*, *Melaleuca acuminata*, *Leptospermum coriaceum*, *Halganea cyanea*, *Prostanthera chlorantha*, *Eremophila glabra* (the type as well as the low, hairy form and the low, sticky, procumbent form), *Myoporum deserti*, *Olearia subspicata*, *Olearia rudis*, *Thysanotus Patersonii*, *Dianella revoluta*, *Pelargonium australe*, *Daucus glochidiatus*, *Dampiera lanceolata*, *Calotis erinacea*, *Helichrysum leucopsidium*, and others. (See Table 6.) These plants appear to be confined almost strictly to Small Mallee areas as their appearance is not noted to any extent in Tall Mallee areas or the Arid Sands (Stunted Mallee), nor do they occur in Pine–Belar or Box Flat areas.

VEGETATION TYPE 5

Stunted Mallee (Arid Sandhill Areas).

This kind of vegetation commences near the high flood limit west of Lake Mournpoul and extends westerly, south of the Nowingi salt lake areas, to the South Australian border north of Murrayville. The surface is generally more undulating than the normal type of Mallee country, and is marked by the presence of prominent sandhills situated within unusually sharp rises and falls. The area consists of arid sand, and carries a type of flora eminently suited to prevent the drift which would occur if the vegetation were removed.

The existing Mallee (*Eucalyptus incrassata*, *Eucalyptus oleosa*, *Eucalyptus dumosa*, and *Eucalyptus viridis*) is reduced to a scrubby state. Bearing foliage to the ground, these species form the principal overhead vegetation, and by moderating the violence of the wind are invaluable in the prevention of soil erosion. Other growths scattered throughout forming the overhead flora are *Exocarpus spartea*, *Fusanus persicarius*, *Callitris verrucosa*, and *Casuarina Muelleriana*. With the exception of *Exocarpus spartea* and *Casuarina Muelleriana*, these growths occur as small trees in Vegetation Type 4 areas. *Casuarina Muelleriana*, which is never large, is confined to this type of country and is rare.

Generally speaking, the area carries a less varied type of vegetation than any other of the vegetation types. The reduced tree growth is very limited in species, and the number of herbaceous plants is small. However, shrub growth is fairly well represented and includes a number of plants which are rigidly confined to the area.

Porcupine Grass (*Triodia irritans*) occupies much of the ground space, and is probably numerically stronger than any other plant. Of the shrubs, *Acacia ligulata*, *Leptospermum coriaceum*, *Acacia rigens*, *Grevillea pterosperma*, and *Aotus villosa* are common. *Acacia acanthoclada*, *Cryptandra amara*, *Hakea flexilis*, *Phebalium glandulosum*, *Bredemeyera scoparium*, and *Baeckea Behrii* are uncommon and, in some cases, rare.

Dampiera lanceolata, *Hibbertia stricta*, *Halgania cyanea*, and *Grevillea ilicifolium* appear more or less throughout. While *Acacia acanthoclada*, *Aotus villosa*, *Hibbertia stricta*, and *Grevillea ilicifolium* follow the valleys, *Hakea flexilis*, *Baeckea Behrii*, *Acacia ligulata*, and *Billardiera cymosa* appear on the higher elevations. Smaller plant growth is extremely limited. Species present are *Vittadinia triloba*, *Loudonia Behrii*, *Myriocephalus Stuartii*, *Podosperma angustifolia*, *Thysanotus Patersonii*, and *Thysanotus Baueri*. The only species that appear to be at home are *Loudonia Behrii*, *Thysanotus Patersonii*, and *Thysanotus Baueri*. The others are dwarfed and are struggling to exist.

It is worthy of note that *Vittadinia triloba* is the only plant that has been located on Box Flat, Pine–Belar, Tall Mallee, Small Mallee, and Arid Sand areas. *Acacia Oswaldii*, which occurs in Vegetation Types 1, 2, 3, and 4, is not found in Vegetation Type 5.

In this area is *Aotus villosa*, which is not located elsewhere in any other vegetation type to the north. Variation is shown in shrubs of *Acacia ligulata* growing side by side, one showing a red aril on the seed and the other a yellowish aril. This is an extremely common occurrence.

Confined to the area and not occurring in other vegetation types are *Casuarina Muelleriana*, *Acacia acanthoclada*, *Billardiera cymosa*, *Baeckea Behrii*, *Aotus villosa*, *Cryptandra amara*, *Bredemeyera scoparium*, and *Loudonia Behrii*.

This arid sand belt has apparently acted as a barrier to the spread of certain plants from the south to the north. Plants such as *Hakea flexilis*, *Hakea ulicina*, *Melaleuca uncinata*, *Baeckea Behrii*, *Eucalyptus calycogona*, *Acacia pycnantha*, *Acacia farinosa*, *Acacia trineura*, *Dodonaea cuneata*, *Eucalyptus Behriana*, *Calythrix tetragona*, *Lasiopetalum Behrii*, and *Helichrysum retusum* commonly occurring to the south, have not been located north of this arid belt. *Acacia pycnantha* extends to near Walpeup, *Eucalyptus Behriana* to near Ouyen, and *Eucalyptus calycogona* to Murrayville. *Hakea flexilis* and *Baeckea Behrii* have entered the arid belt but do not occur frequently. *Eucalyptus leucoxylon* and *Eucalyptus capitellata* seem to have reached their northern limit six miles to the south of Murrayville. *Acacia spinescens*, *Acacia calamifolia*, *Acacia farinosa*, *Acacia trineura*, *Dodonaea cyneata*, *Calythrix tetragona*, *Lasiopetalum Behrii*, *Hakea ulicina*, and *Melaleuca uncinata* do not occur in the area and have not been observed further north.

TABLE 6.—VEGETATION TYPES 3, 4, AND 5.

(*Mallee Areas.*)

Group 1—Trees — Prominent (P)
Group 2—Shrubs and Semi Shrubs — Frequent (F)
Group 3—Small Plants often Seasonal — Occasional (O)
Group 4—"Others" — Rare (R)

"x" indicates occurrence.

Group No.	Species.		Occurrence in Vegetation Types—					
			1.	2.	3.	4.	5.	6.
1	*Eucalyptus incrassata*	P	..	..	x	x	x	x
	Eucalyptus dumosa	P	..	..	x	x	x	..
	Eucalyptus gracilis	P	..	..	x	x	..	..
	Eucalyptus oleosa	P	..	..	x	x	x	..
	Eucalyptus viridis	P	..	..	x	x	x	..
	Hakea vittata	O	..	x	x	x	..	..
	Hakea leucoptera	F	..	x	x	x	..	x
	Pittosporum phillyreoides	F	x	x	x	..	..	..
	Heterodendron oleifolium	F	x	x	x	..	..	..
	Myoporum platycarpum	F	..	x	x	x	..	..
	Acacia homalophylla	O	x	..	x	..	..	..
	Acacia Oswaldii	F	x	x	x	x	..	..
	Acacia Victoriae	O	x	..	x	..	..	..
	Fusanus acuminatus	O	x	x	x	..	..	..
	Melaleuca pubescens	O	x	..	x	x	..	..
	Callitris verrucosa	F	..	..	..	x	x	..
	Exocarpus spartea	F	..	..	..	x	x	..
	Fusanus persicarius	O	..	..	..	x	x	..
	Codonocarpus cotinifolius	O	..	..	..	x	..	..
	Casuarina Muelleriana	R	..	..	..	..	x	..
2	*Grevillea Huegelii*	F	..	x	x	..	..	..
	Exocarpus aphylla	F	..	x	x	..	..	..
	Lepidium leptopetalum	O	..	x	x	..	..	..
	Blennodia trisecta	R	..	..	x	..	..	..
	Cassia eremophila	F	..	x	x	..	..	..
	Cassia Sturtii	F	..	x	x	..	..	..
	Acacia obliqua	F	..	x	x	x	..	..
	Acacia microcarpa	F	..	..	x	x	..	..
	Acacia hakeoides	F	..	x	x	x	..	..
	Acacia colletioides	F	..	x	x	x	..	..
	Acacia ligulata	F	..	x	..	x	x	..
	Acacia rigens	F	..	..	x	x	x	..
	Acacia sclerophylla	F	..	..	x	x	..	..

TABLE 6—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
2	*Marsdenia australis*	R	..	X	X	X	..	..
	Dodonaea attenuata	F	..	X	X	..	..	..
	Solanum esuriale	F	X	..	X	..	..	..
	Solanum simile	F	X	..	X	..	..	..
	Eremophila glabra	F	..	X	X	X	..	..
	Eremophila crassifolia	R	..	..	..	X	..	..
	Eremophila glabra (hairy type)	R	..	..	..	X	..	..
	Eremophila glabra (low sticky type)	F	..	..	X	X	..	..
	Eremophila maculata	F	X	X	X	..	..	..
	Eremophila scoparia	O	..	..	X	X	..	..
	Eremophila longifolia	O	..	X	X	..	..	..
	Eremophila Sturtii	R	..	..	X	..	..	..
	Olearia magniflora	O	..	..	X	..	..	..
	Olearia pimeleoides	F	..	X	X	..	..	..
	Olearia Muelleri	F	..	X	X	X	..	..
	Halgania lavandulacea	F	..	..	X	X	..	..
	Westringia rigida	F	..	..	X	..	..	..
	Grevillea pterosperma	O	..	..	..	X	X	..
	Muehlenbeckia diclina	O	..	..	..	X	..	..
	Phebalium glandulosum	R	..	..	..	X	X	..
	Bertya Mitchellii	O	..	..	..	X	..	..
	Beyeria opaca	F	..	..	..	X	..	..
	Dodonaea bursariifolia	F	..	..	..	X	..	..
	Dodonaea stenozyga	O	..	..	..	X	..	..
	Plagianthus Berthae	R	..	..	..	X	..	..
	Melaleuca acuminata	O	..	..	..	X	..	..
	Leptospermum coriaceum	P	..	..	..	X	X	..
	Halgania cyanea	F	..	..	..	X	X	..
	Prostanthera chlorantha	F	..	..	..	X	..	..
	Myoporum deserti	O	..	..	..	X	..	..
	Olearia subspicata	R	..	..	..	X	..	..
	Olearia rudis	O	..	..	..	X	..	..
	Olearia lepidophylla	O	..	..	..	X	..	..
	Olearia ramulosa	O	..	..	..	X	..	..
	Acacia acanthoclada	R	..	..	..	..	X	..
	Hakea flexilis	R	..	..	..	..	X	..
	Grevillea ilicifolia	O	..	..	..	..	X	..
	Billardiera cymosa	O	..	..	..	..	X	..
	Baeckea Behrii	O	..	..	..	..	X	..
	Baeckea crassifolia	O	..	..	..	..	X	..
	Aotus villosa	O	..	..	..	..	X	..

TABLE 6—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
2	*Hibbertia stricta*	F	..	..	..	X	X	..
	Cryptandra amara	O	..	..	..	..	X	..
	Cryptandra leucophracta	O	..	..	..	X	..	..
	Bredemeyera scoparium	R	..	..	..	..	X	..
	Dampiera lanceolata	O	..	..	..	X	X	..
	Bursaria spinosa	R	..	..	..	X	..	..
	Templetonia sulcata	R	..	..	..	X	..	..
	Hybanthus floribundus	O	..	..	..	X	..	..
	Minuria Cunninghamii	O	..	..	X	..	..	X
	Leptomeria aphylla	O	..	..	X	..	..	..
	Lycium australe	O	..	..	X	..	..	..
	Lasiopetalum Baueri	R	..	..	..	X	..	..
	Gyrostemon australasicus	R	..	..	..	..	X	..
	Leucopogon cordifolius	R	..	..	..	X	..	..
3	*Trichinium exaltatum*	F	..	..	X	X	..	..
	Trichinium spathulatum	F	..	..	X	X	..	..
	Zygophyllum apiculatum	F	..	..	X	..	..	..
	Zygophyllum fruticulosum	F	..	..	X	X	..	..
	Zygophyllum crenatum	F	..	..	X	X	..	..
	Zygophyllum iodocarpum	O	..	..	X	..	..	..
	Clematis microphylla	F	..	..	X	X	..	..
	Ajuga australis	F	X	..	X	..	..	..
	Nicotiana suaveolens	O	..	..	X	..	..	..
	Wahlenbergia gracilis	O	X	X	X	..	..	..
	Dampiera rosmarinifolia	O	..	..	X	X	..	..
	Vittadinia triloba	F	X	X	X	X	X	..
	Minuria leptophylla	O	..	..	X	..	..	X
	Myriocephalus Stuartii	F	..	..	X	X	X	..
	Myriocephalus rhizocephalus	O	..	..	X	X	..	X
	Helichrysum apiculatum	F	..	..	..	..	..	..
	Helichrysum bracteatum	O	..	..	X	..	..	..
	Craspedia uniflora	F	X	..	X	..	..	..
	Craspedia pleiocephala	F	X	..	X	..	..	..
	Millotia tenuifolia	O	..	X	X	..	..	..
	Helipterum floribundum	F	..	..	X	X	..	X
	Helipterum corymbiflorum	F	X	..	X	..	..	X
	Helipterum anthemoides	F	..	..	X	..	..	..
	Helipterum pygmaeum	F	..	..	X	..	..	X
	Helipterum Jesseni	F	..	..	X	..	..	X
	Helipterum demissum	O	..	..	X	X	..	..
	Angianthus strictus	O	..	..	X	..	..	..

TABLE 6—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Angianthus brachypappus*	O	..	..	X	..	..	X
	Angianthus pusillus	O	..	..	..	X	..	..
	Goodenia geniculata	O	..	..	X	X	..	..
	Gnaphalium luteo-album	F	X	..	X	..	..	..
	Podosperma angustifolium	O	..	..	X	X	X	..
	Athrixia tenella	O	..	..	X	..	..	..
	Calocephalus Sonderi	F	X	..	X	X	..	X
	Calocephalus Drummondii	O	..	..	X	X	..	..
	Senecio lautus	F	..	..	X	X	..	..
	Thysanotus Patersonii	O	..	..	..	X	X	..
	Dianella revoluta	O	..	..	..	X	..	..
	Trichinium obovatum	O	..	..	..	X	..	..
	Pelargonium australe	O	..	..	..	X	..	..
	Daucus glochidiatus	F	..	..	..	X	..	..
	Didiscus cyanopetalus	R	..	..	..	X	..	..
	Goodenia robusta	O	..	..	..	X	..	..
	Helichrysum leucopsidium	F	..	..	..	X	..	..
	Waitzia acuminata	F	..	..	..	X	..	..
	Lomandra multiflora	O	..	..	..	X	..	..
	Lomandra leucocephala	O	..	..	..	X	..	..
	Gahnia lanigera	R	..	..	..	X	..	..
	Lepidosperma concavum	O	..	..	..	X	X	..
	Loudonia Behrii	O	..	..	..	..	X	..
	Thysanotus Baueri	R	..	..	..	..	X	..
	Brachycome pachyptera	F	X	X	X	..	..	X
	Triglochin calcitrapa	O	..	..	X	..	..	..
	Hypoxis glabella	F	..	..	X	..	..	X
	Pterostylis concinna	R	..	..	..	..	X	..
	Pterostylis cycnocephala	R	..	..	..	X	..	..
	Pterostylis mutica	R	..	..	..	X	..	..
	Tricoryne elatior	R	..	..	..	X	..	..
	Calandrinia calyptrata	O	..	..	X	X	..	..
	Calandrinia corrigioloides	R	..	..	..	X	..	..
	Halorrhagis odontocarpa	O	..	..	..	X	..	..
	Plagiobothrys elachanthus	O	..	..	X	..	..	X
	Lappula concava	O	..	..	X	X	..	..
	Calotis hispidula	F	..	..	X	..	..	X
	Gnaphalodes uliginosum	F	..	..	X	X	..	X
	Leptorhynchus tetrachaetus	O	..	..	X	X	..	..
	Cotula coronopifolia	O	..	..	X	..	..	X
	Isoetopsis graminifolia	O	..	..	X	..	..	..

TABLE 6—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Centipeda thespidioides*	R	..	..	X	..	..	..
	Caladenia dilatata	R	..	..	X	..	..	..
	Anthocercis myosotidea	R	..	..	..	..	X	..
	Erodium cygnorum	O	..	..	X	X	..	..
	Stenopetalum sphaerocarpum	O	..	X	..	X	..	..
	Stenopetalum lineare	F	..	X	X	X	..	..
	Ceratogyne obionoides	R	..	..	..	X	..	..
4	*Cassytha melantha*	F	..	X	X	X	X	..
	Loranthus Miquelii	F	X	X	X	X	..	..
	Loranthus exocarpi	F	X	X	X	X	..	..
	Loranthus Preissii	F	X	X	X	X	..	..
	Loranthus miraculosus var. Boormannii ..	O	..	X	X	..	..	..
	Rhagodia spp.	F	X	..	X	X	X	X
	Rhagodia spinescens	O	..	..	..	X	..	..
	Atriplex halimoides	O	X	..	X	..	..	X
	Atriplex vesicarium	F	..	..	X	..	..	X
	Atriplex rhagodioides	O	..	..	X	X	..	..
	Atriplex campanulatum	O	..	..	X	X	..	X
	Atriplex stipitatum	R	..	..	..	X	..	..
	Bassia paradoxa	F	..	..	X	..	..	X
	Bassia biflora	F	..	..	..	X	..	..
	Bassia patenticuspis	F	..	..	X	X	..	X
	Kochia aphylla	R	..	..	..	X	..	X
	Kochia triptera	F	..	..	..	X	..	..
	Kochia triptera var. pentaptera	F	..	..	X	X	..	..
	Kochia brevifolia	F	..	..	X	..	..	X
	Kochia oppositifolia	R	..	..	..	X	..	..
	Kochia sedifolia	F	X	X	X	X	..	..
	Stipa scabra	F	..	X	X	..	..	..
	Stipa elegantissima	O	..	..	X	X	..	..
	Stipa eremophila	O	..	..	X	..	..	..
	Stipa semibarbata	O	..	X	X	X	..	..
	Stipa acrociliata	O	..	..	X	X	..	..
	Stipa platychaeta	O	..	..	X	X	..	..
	Stipa Drummondii	O	..	..	X	X	..	..
	Triodia irritans	P	..	..	..	X	X	..
	Poa Drummondiana	R	..	..	..	X	..	..
	Amphipogon strictus	R	..	..	..	X	..	..
	Danthonia spp.	F	X	X	X	X	..	..
	Paspalidium gracile	R	..	..	X	..	..	..

SOILS SUPPORTING VEGETATION TYPES, 3 4 AND 5

Soil Division 3.

Soil Group 3.

Soil Types 13, 14, 15, 16, and 17.

Soil Group 4.

Soil Types 18, 19, 20, and 21.

Soil Group 5.

Soil Types 22 and 23.

A summary of the soils of Division 3 is given in Table 7. Soil Group 3 is representative of areas supporting Tall Mallee (Vegetation Type 3), while Groups 4 and 5 support Small Mallee (Vegetation Type 4) and Stunted Mallee (Vegetation Type 5) respectively. The colour of the soils of this division is generally of a brown to light-brown, the red-brown shades being typical of Soil Group 2. As in Group 2 the reaction is alkaline, and generally the soils of this division are lighter in texture than those of Groups 1 and 2.

The heaviest types of Division 3 belong to Group 3. Group 4 soils become a good deal lighter, being composed principally of sand to sandy loam, and are an intermediate group between the heavier types of Group 3 and the sands of Group 5. The changes from soils of moderate heaviness (Group 3) to the light types of Group 5 is reflected in the predominating vegetation passing from Tall Mallee to Small Mallee and finally becoming stunted in the sandy soils of Group 5.

The soils of Group 3 occur in gently undulating country with the greatest distance between the parallel rises. Extensive areas of flat to almost flat land occur between the rises. As the parallel rises become closer and higher the soils change to those of Group 4. The sands belonging to Group 5 lie further to the south and support Vegetation Type 5 (see Vegetation Map). This class of country consists of deep sands both in the depressions and on the ridges, some of which are very considerable. The whole formation is composed of sandhills with sandy depressions between the ridges.

Soil Group 3.

An outstanding feature of the soils of Group 3 is the amount of calcium carbonate visible in the profile. This may occur in the nodular form, as small rubble or large stones, or perhaps even as sheet limestone. " Lime " in the soft form is generally present in large amounts, often presenting the appearance of a marl.

Type 13 is representative of the soils of small " flats " between sand ridge soils belonging to Group 4 (Fig. 6). The absence of visible lime above 24 inches, and the appearance of a light clay horizon between 14 inches and 24 inches, removes the type from the Loveday Sandy Loam described by Marshall and Hooper (7).

Type 14 is a lighter soil and resembles the Barmera Sandy Loam of Marshall and Hooper (7). This soil is usually found forming the low ridges.

Another low ridge type is Type 15, which has much in common with the Loveday Sandy Loam. An important feature of this type is the presence of large amounts of nodular limestone or rubble near the surface. This is the heaviest type in Group 3, the deep subsoil grading from a light clay to a red-brown medium clay (Fig. 7).

The occurrence of Blue-bush flats of any extent appears to be mostly confined to areas coming within the boundaries of Vegetation Type 3. It is therefore desirable to include Soil Type 17 of the Blue-bush areas in Soil Group 3, rather than in Soil Group 6 (Salt-bush Plains). The appearance of small patches of *Kochia pyramidata* and *Kochia sedifolia* in soils of Group 6 is not to be regarded as typical. Although this happens, the supporting soils belong more to Type 29 than to Type 17. Type 17 is a heavy soil. The surface horizon is a light-brown loam overlying a clay loam. The subsoil consists of a light clay with varying amounts of lime and rubble which, however, do not appear in a pronounced form. At 24 inches the texture changes to a medium clay and considerable lime is present with some nodular limestone. This horizon extends to about 48 inches, when a decrease in lime is noticed in the heavy clay (Fig. 8).

Soil Group 4.

The soils of Group 4 are composed mainly of sands, and with the exception of Type 18 have a good deal in common with Winkie Sand described by Marshall and Hooper (7). The heaviest type (Type 18) exhibits a close affinity to some soils belonging to Group 3, and the lightest type (Type 20) is close to the sands of Group 5.

Type 18 belongs to the " flats " between Winkie Types. The surface horizon is a brown sandy loam. At about 7 inches and continuing to 26 inches a light-brown sandy clay loam, with large amounts of small rubble and lime, overlies a sandy clay. The sandy clay deep subsoil exhibits much lime, but rubble is not present (Fig. 9).

Sandy depressions between the more abrupt sand ridges consist of soils of which Type 19 is typical. Type 20 and Type 21 are featured in Table 7.

Soil Group 5.

The soils of this group exhibit little variation. As a general rule the soil colour is a light-brown, and in appearance these soils are the lightest in colour of the soils of Division 3.

The great depth of loose sand, and the small quantity of visible calcium carbonate above 60 inches, are features of Soil Types 22 and 23. Boring with the auger revealed only sand down as far as 12 feet. Type 22, which is characteristic of the valleys between the ridges, consists of loose sand, with the appearance of very slight lime below 6 inches. Lime increases with depth, but is not marked (Fig. 10). Type 23 belongs to the sand ridges, and lime is not visible down as far as 12 feet.

Table 7.—Summary of Soil Type Descriptions.

Division 3.—Groups 3, 4 and 5.

Soil Group.	Soil Type.	Surface.	Subsoil.	Deep Subsoil.	Remarks.
3	13	Red-brown sandy loam 0–5″	Red-brown sandy clay loam 5–14″. Brown light clay 14–24″	Light-brown sandy clay, small amount of rubble with considerable lime 24–42″. Light-brown sandy clay with much large rubble 42–60″	Tall Mallee. Flat
3	14	Dark-brown sand 0–4″	Brown sandy loam 4–12″. Brown loam 12–24″	Light-brown sandy clay loam with considerable lime and some small nodular limestone 24–48″. Light-brown sandy clay loam, no nodules 48–60″. Large rubble at 60″	Low ridge in Tall Mallee
3	15	Dark-brown sand 0–4″	Brown sandy loam 4–16″, slight lime coming in at 12″. Light-brown sandy clay loam with much nodular limestone and some lime 16–29″	Light-brown light clay with much lime 29–46″. Red-brown medium clay 46–60″	Low ridge in Tall Mallee
3	16	Brown sandy loam 0–6″	Light-brown sandy loam with much nodular limestone and large rubble 6–18″. Light-brown sandy clay loam with much nodular limestone and lime 18–36″	Light-brown sandy clay loam, no nodules, much lime 36–48″. Light-brown light clay, slight lime 48–60″	Tall Mallee. Flat
3	17	Light-brown loam 0–4″	Light-brown clay loam 4–12″. Light-brown light clay, few nodules to 15″ and lime increasing 12–24″	Light-brown medium clay with few nodules and much lime 24–48″. Light-brown heavy clay, no nodules, and lime decreasing 48–60″	Blue-bush Flats in Tall Mallee Areas. No Mallee
4	18	Brown sandy loam 0–7″	Light-brown sandy clay loam with considerable lime and small rubble 7–26″	Light-brown sandy clay with much lime, no rubble 26–60″	Small Mallee. Flat land
4	19	Light-brown sand 0–5″	Brown sand. Some lime 5–23″	Red-brown sand with considerable lime and small rubble 23–28″. Light-brown sand, rubble decreasing, some nodular limestone and lime 28–60″	Small Mallee. Flat land
4	20	Light-brown sand 0–2″	Red-brown sand 2–24″	Red-brown sand 24–60″ ..	Small Mallee. Sand ridge
4	21	Red-brown sand 0–24″	Red-brown sand with slight lime 24–48″	Red-brown sandy loam with slight lime 48–60″	Small Mallee. Flat land
5	22	Light-brown sand 0–6″	Light-brown sand with very slight lime 6–24″	Red-brown sand, slight lime 24–36″. Light-brown sand, slight lime 36–60″	Stunted Mallee. Depressions in sand ridges
5	23	Light-brown sand 0–24″	Light-brown sand ..	Light-brown sand 24–60″ ..	Stunted Mallee. Sand ridges

TYPE 13.

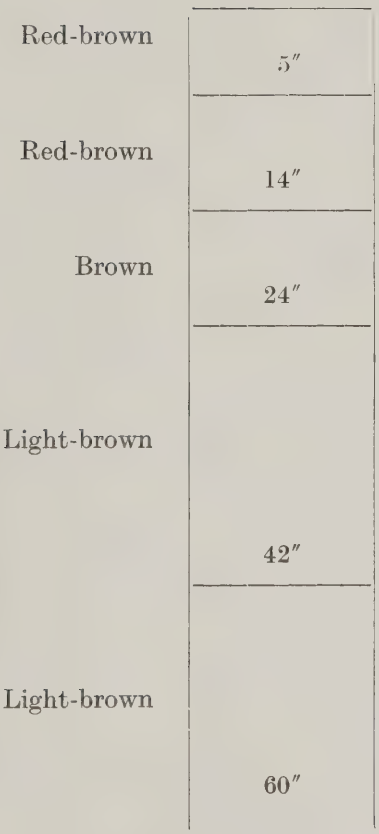

Red-brown
5″
Sandy loam
Red-brown
14″
Sandy clay loam
Brown
24″
Light clay
Light-brown
42″
Sandy clay. Considerable lime, small amount of rubble
Light-brown
60″
Sandy clay. Large amount of big rubble

Fig. 6.

TYPE 15.

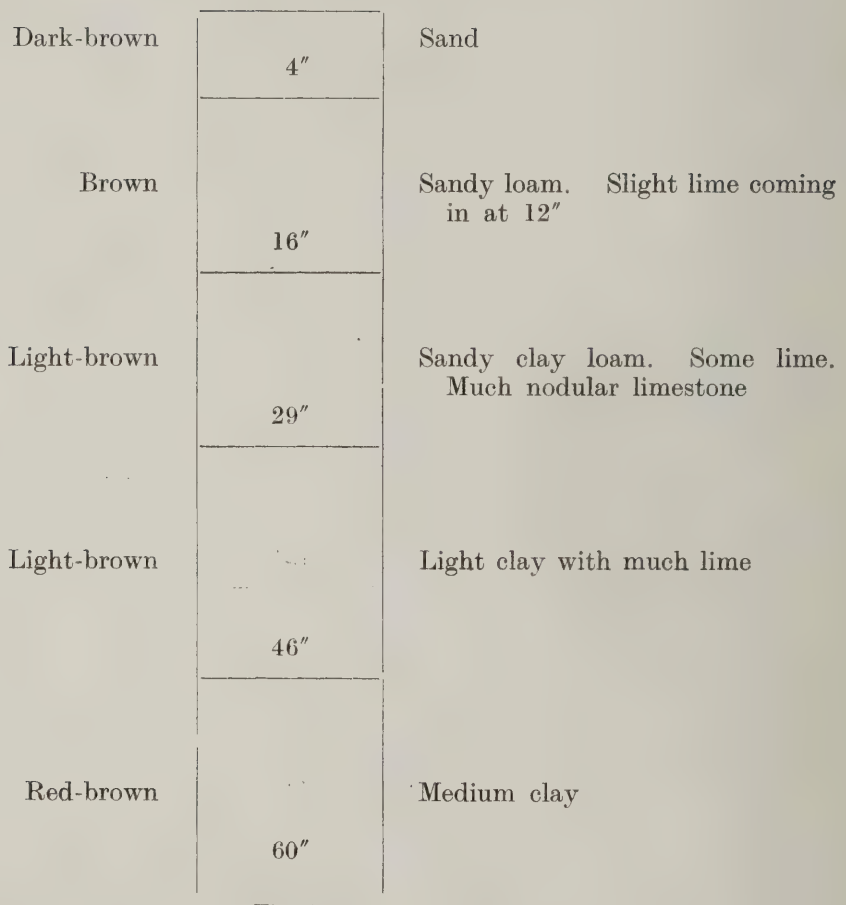

Dark-brown
4″
Sand
Brown
16″
Sandy loam. Slight lime coming in at 12″
Light-brown
29″
Sandy clay loam. Some lime. Much nodular limestone
Light-brown
46″
Light clay with much lime
Red-brown
60″
Medium clay

Fig. 7.

TYPE 17.

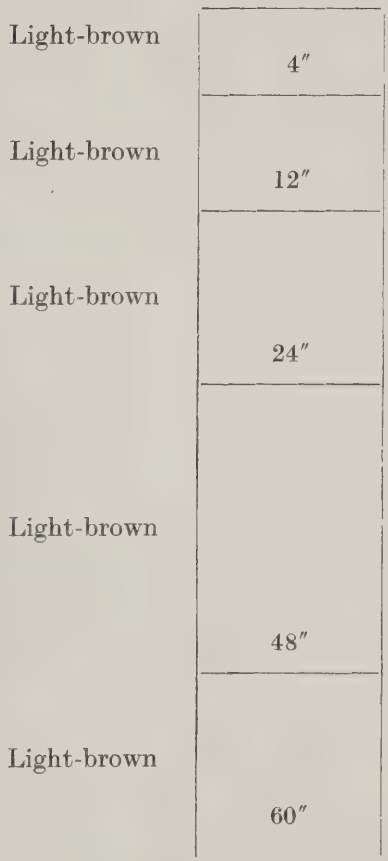

Light-brown
4″
Loam
Light-brown
12″
Clay loam
Light-brown
24″
Light clay. Slight lime and nodular limestone
Light-brown
48″
Medium clay. Considerable lime. Slight nodular limestone
Light-brown
60″
Heavy clay. Lime decreasing. No nodules

Fig. 8.

TYPE 18.

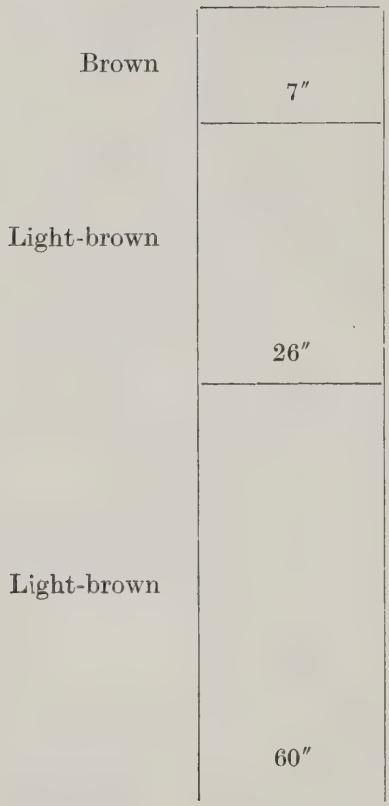

Brown
7″
Sandy loam
Light-brown
Sandy clay loam with considerable small rubble and lime
26″
Light-brown
Sandy clay with much lime. No rubble
60″

Fig. 9.

TYPE 22.

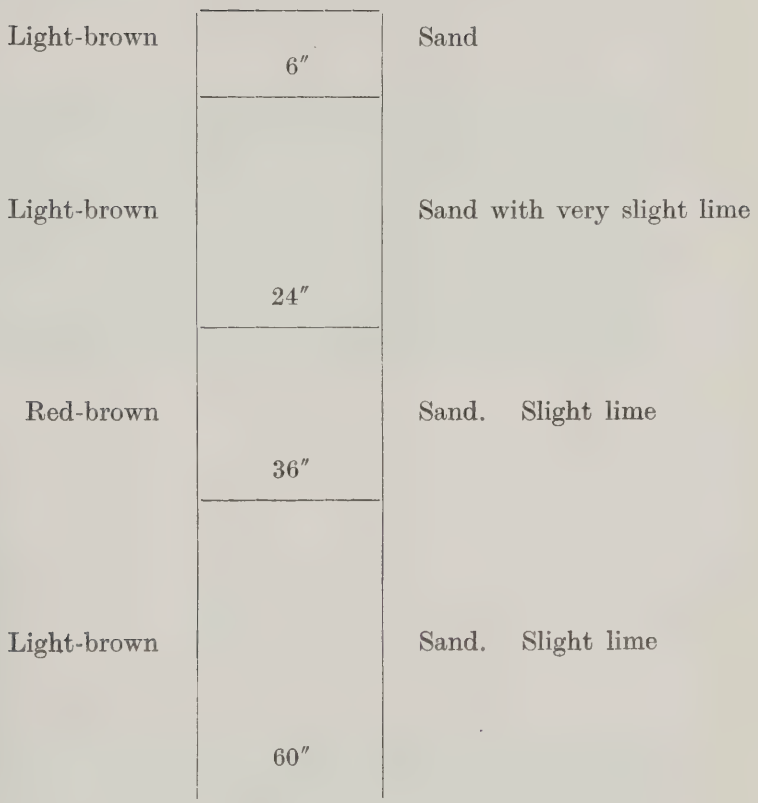


Fig. 10.

Deep Horizons.

60– 84″ .. Light-brown sand with slight lime and small rubble.
84–108″ .. Light-brown sand, rubble increasing.
108–144″ .. Red-brown sand. Moderate amount small rubble.

VEGETATION TYPE 6

SALT-BUSH PLAINS.

The Salt-bush Plains can be divided into *three* main sections (see Vegetation Map) :—

Section 1.

Areas in which the predominating vegetation consists of *Atriplex vesicarium.*

Section 2.

Areas in which the predominating vegetation is *Pachycornia triandra.*

Section 3.

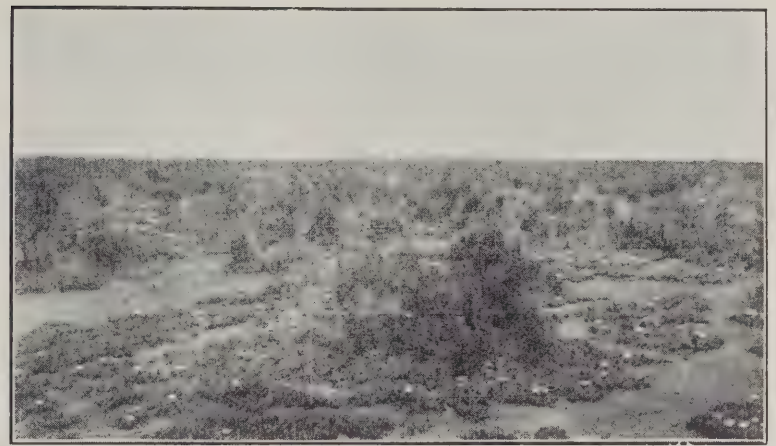
Areas in which the predominating vegetation is *Arthrocnemum halocnemoides.*

Section 1 covers an extensive area in the far north-western corner of the State. Much of this section is badly wind-swept. The predominating vegetation is *Atriplex vesicarium*, but as the western extremity of the area is approached, this species gives way to a mixed growth of *Kochia pyramidata*, *Atriplex halimoides*, *Atriplex leptocarpum*, *Chenolea spp.*, *Mesembrianthemum australe* and *Bassia spp.* The only tree growth on these plains is an occasional *Hakea leucoptera* or a few *Eucalyptus incrassata* which have taken possession of slightly higher ground. *Nitraria Schoberi* is the only large shrub growth. An occasional patch of *Glyceria ramigera* appears, and *Trichinium nobile* is rare.

Section 1 exhibits considerable evidence of wind-sweeping, much of the country being devoid of vegetation and surface soil alike. With the removal of the vegetation, water is rapidly cutting out small " wash-outs " and gutters. The surface soil is often accumulated against *Nitraria Schoberi*, and in some cases the plant is almost covered (up to 4 feet) and ultimately dies. The present situation is largely attributable to excessive grazing. Salt-bushes which originally clothed the area have consistently been eaten back, with the result that regeneration has been precluded. Wind-sweeping has removed the surface soil, leaving herbage struggling on mounds and there endeavouring to exist and propagate its kind under adverse conditions. The possibility of these windswept areas returning to a fully clothed state is extremely remote.

Atriplex vesicarium is the predominant growth on Section 1 of the salt-bush plains.

Vegetation Type 6.



Pachycornia triandra predominates on Section 2. The flowering plant in the photograph is *Mesembrianthemum australe.*

Arthrocnemum halocnemoides (Saltbush). The salt incrustation on the surface is often pronounced. Section 3 of the salt-bush plains.

Section 2 adjoins Section 1 on the east, the predominating species being *Pachycornia triandra*. The soils of this area are of a heavy surface nature, and this feature, combined with the dislike of stock and rabbits for this species, makes wind erosion unimportant. *Mesembrianthemum australe* is commonly present, and occasionally scattered *Eucalyptus bicolor* occupies the lowest levels.

Section 3 lies to the west of Nowingi. This area is comprised of a series of saline basins, some of which cover thousands of acres. *Arthrocnemum halocnemoides* is the chief species of vegetation, with *Mesembrianthemum australe* and *Frankenia augustipetala* next in importance. *Melaleuca halmaturorum* is present on the rims of the depressions but is rare. Soluble salts sometimes occur in such extreme amounts that even *Arthrocnemum halocnemoides* (which appears to withstand saline conditions better than any other plant) cannot establish itself. The lowering of the amount of soluble salts in the soil moisture by heavy downpours of rains is later reflected in the fresh appearance of the vegetation.

Other plants occurring in Vegetation Type 6 are shown in Table 8.

TABLE 8.—VEGETATION TYPE 6.

(*Salt Bush Plains.*)

Group 1—Trees	Prominent (P)
Group 2—Shrubs and Semi Shrubs	Frequent (F)
Group 3—Small Plants often Seasonal	Occasional (O)
Group 4—" Others "	Rare (R)

" X " indicates occurrence.

Group No.	Species.		Occurrence in Vegetation Types—					
			1.	2.	3.	4.	5.	6.
1	*Eucalyptus incrassata*	O	..	..	X	X	X	X
	Hakea leucoptera	O	..	X	X	X	..	X
	Melaleuca halmaturorum	R	..	..	..	..	..	X
2	*Nitraria Schoberi*	R	..	X	X	..	..	X
3	*Mesembrianthemum australe*	P	X	..	..	..	..	X
	Trichinium nobile	R	..	..	..	..	..	X
	Calocephalus Sonderi	F	X	..	X	X	..	X
	Frankenia angustipetala	F	..	..	..	..	..	X
	Frankenia foliosa	F	..	..	..	..	..	X
	Gnephosis skirrophora	O	..	..	..	..	..	X
	Goodenia pinnatifida	O	X	..	..	..	..	X

TABLE 8—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
3	*Minuria leptophylla*	O	..	..	X	..	..	X
	Ixiolaena leptolepis	O	..	..	..	..	..	X
	Microseris scapigera	F	..	..	..	..	..	X
	Thysanotus tuberosus	F	..	..	X	..	..	X
	Helipterum Jesseni	F	..	..	..	X	..	X
	Helipterum floribundum	F	..	..	X	X	..	X
	Helipterum moschatum	F	..	..	X	..	..	X
	Helipterum pygmaeum	O	..	..	X	X	..	X
	Angianthus brachypappus	O	..	..	..	..	..	X
	Myriocephalus rhizocephalus	O	..	..	X	X	..	X
	Cotula coronopifolia	O	..	..	..	..	..	X
	Triglochin calcitrapa	O	..	..	..	..	..	X
	Hutchinsia procumbens	O	..	X	..	..	..	X
	Cynoglossum australe	O	..	..	..	..	..	X
	Brachycome pachyptera	F	X	X	X	..	..	X
	Calotis hispidula	F	..	..	X	..	..	X
	Spergularia rubra	F	..	..	..	..	..	X
	Senecio brachyglossus	O	..	..	..	..	..	X
	Senecio platylepis	R	..	..	..	..	..	X
	Hypoxis glabella	O	..	..	..	..	..	X
	Zygophyllum glaucescens	O	..	..	..	..	..	X
	Teucrium racemosum var tripartitum ..	O	..	..	..	..	..	X
	Eriochlamys Behrii	O	..	..	..	..	..	X
4	*Atriplex Muelleri*	O	..	..	X	..	..	X
	Atriplex angulatum	R	..	..	X	..	..	X
	Atriplex nummularium	F	X	..	..	..	..	X
	Atriplex semibaccatum	F	X	..	..	..	..	..
	Atriplex halimoides	O	X	..	..	..	..	X
	Atriplex spongiosum	F	X	..	..	..	..	X
	Atriplex vesicarium	P	..	..	X	..	..	X
	Rhagodia crassifolia	O	..	..	..	..	..	X
	Bassia sclerolaenoides	O	..	X	X	..	..	..
	Bassia paradoxa	F	..	..	X	X	..	X
	Bassia uniflora	F	X	..	X	X	..	X
	Bassia patenticuspis	F	..	..	X	X	..	..
	Bassia tricuspis	O	X	..	..	..	..	X
	Bassia quinquecuspis	R	..	X	X	..	..	..
	Chenolea tricornis	O	X	..	..	..	..	X
	Kochia brevifolia	F	X	..	..	..	..	X

TABLE 8—*continued.*

Group No.	Species.		Occurrence in Vegetation Types—						
				1.	2.	3.	4.	5.	6.
4	*Kochia triptera*	O	..	..	X	..	..	X
	Kochia triptera var pentaptera	O	..	..	X	X	..	X
	Kochia tomentosa	O	X	..	..	..	..	X
	Kochia pyramidata	F	..	..	X	..	..	X
	Kochia sedifolia	P	..	..	X	..	..	X
	Kochia appressa	O	..	..	..	X	..	X
	Kochia aphylla	R	..	..	..	X	..	X
	Enchylaena tomentosa	F	X	..	X	X	..	X
	Salsola Kali	F	X	..	X	X	..	X
	Salicornia australis	F	..	..	..	..	..	X
	Arthrocnemum halocnemoides	F	..	..	..	..	..	X
	Pachycornia triandra	P	..	..	..	..	..	X

SOILS SUPPORTING VEGETATION TYPE 6

SOIL DIVISION 4.

Soil Group 6.

Soil Type 24, 25, and 26.

The soils of Group 6 are summarized in Table 9. The soils are characterized by the presence of marked amounts of gypsum and soluble salts.

Type 24 is typical of soils supporting mainly *Atriplex vesicarium.* The surface horizon consists of a red-brown sandy loam. Moderate amounts of lime occur between 15 and 36 inches. Soils belonging to this type do not show the large amounts of gypsum which are visible in Types 25 and 26. The light surface horizon when unprotected by vegetation readily blows away.

Areas in which the predominating growth is *Pachycornia triandra* (Section 2, Vegetation Map) do not suffer from wind erosion, as the surface horizon is composed of a medium clay. Type 25 shows this soil to be very heavy (Fig. 11). Slight amounts of lime are visible between 12 inches and 30 inches, and considerable gypsum in a coarsely crystalline condition appears below 30 inches, but decreases with depth.

Arthrocnemum halocnemoides is the only important growth on soils of Type 26. These areas occupy depressions in the dry salt basins west of Nowingi (See Vegetation Map). The water table is frequently met with at 48″, and gypsum is present in very marked amounts. The percentage of soluble salts is very high. A feature is the incrustation of white alkali on the surface, causing a distinct surface puffiness. In extreme cases, the large quantities of sodium chloride and sodium sulphate prevent any vegetation from establishing itself.

Table 9.—Summary of Soil Type Descriptions.

Division 4.—Group 6.

Soil Group.	Soil Type.	Surface.	Subsoil.	Deep Subsoil.	Remarks.
6	24	Red-brown sandy loam 0–9″	Red-brown clay loam 9–15″. Red-brown clay loam with moderate lime 15–24″	Light-brown light clay, lime increasing 24–36″. Yellowish-grey sandy clay, slight gypsum 36–60″	*Atriplex vesicarium*
6	25	Grey - brown medium clay 0–3″	Grey heavy clay 3–12″. Grey heavy clay with slight lime 12–30″	Light-brown heavy clay with considerable gypsum 30–38″. Mottled grey and yellow heavy clay, gypsum moderate 38–60″	*Pachycornia triandra*
6	26	Brown loam with much gypsum 0–6″	Light-brown heavy clay with considerable large gypsum crystals 6–18″. Gypsum band 18–27″	Mottled grey and yellow sandy clay with considerable large gypsum crystals 27–48″. Water table at 48″. Grey medium clay, no gypsum crystals 48–60″	*Arthrocnemum halocnemoides*

TYPE 25.

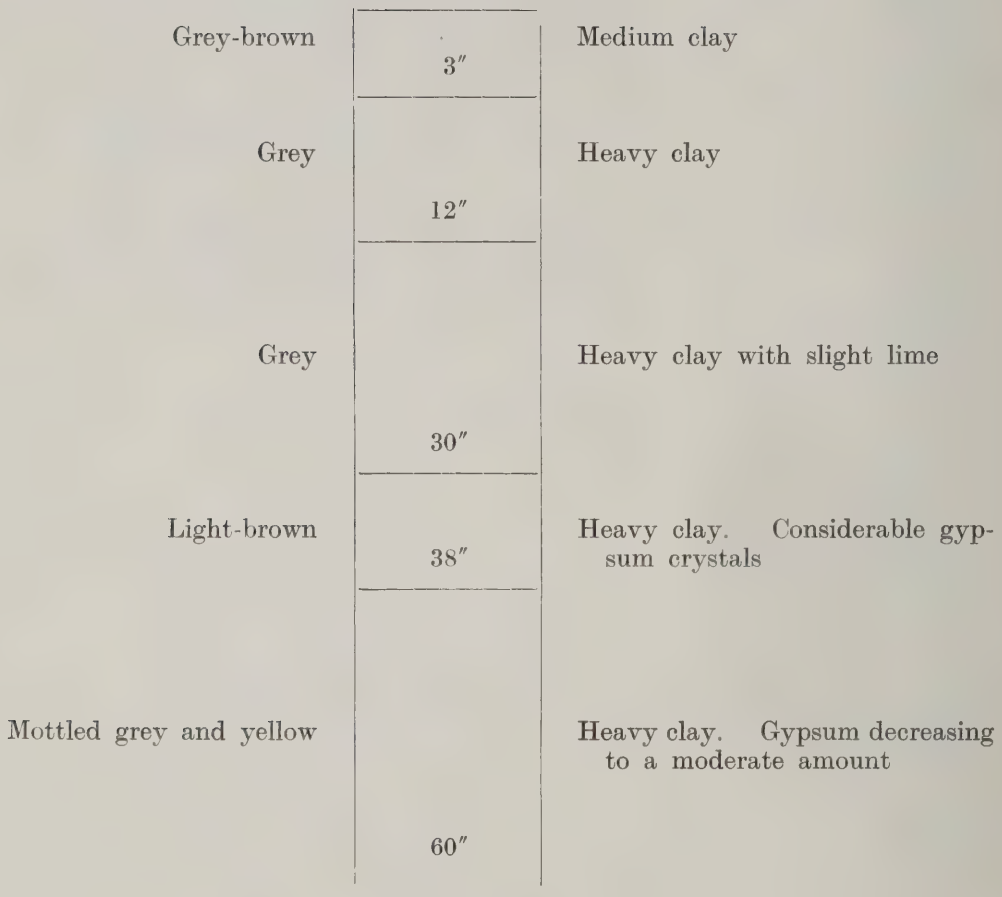


Fig. 11.

60–72″ .. Mottled grey and yellow heavy clay. Moderate gypsum crystals.
72–84″ .. Mottled grey and yellow heavy clay. Moderate gypsum crystals.

THE RELATIONSHIP BETWEEN SOILS AND VEGETATION

After consideration has been given to the small margin of difference in the yearly rainfall averages set out in Table 1, it is apparent that rainfall is not a factor in the distribution of the several vegetation types. Assuming that Willah and Hattah actually do receive between 12 inches and 13 inches annually (see note in Climatic Features), these places are situated in areas supporting mostly vegetation of Types 4 (Small Mallee), and 5 (Stunted Mallee). This circumstance clearly indicates poorer soil conditions. That rainfall is not a factor in the distribution of the various types of vegetation is further illustrated by the occurrence of sharply defined, smaller patches of other vegetation types within the type. For example, Box Flat areas

Diagram Illustrating the Relationship between Soil Types and Vegetation Types.

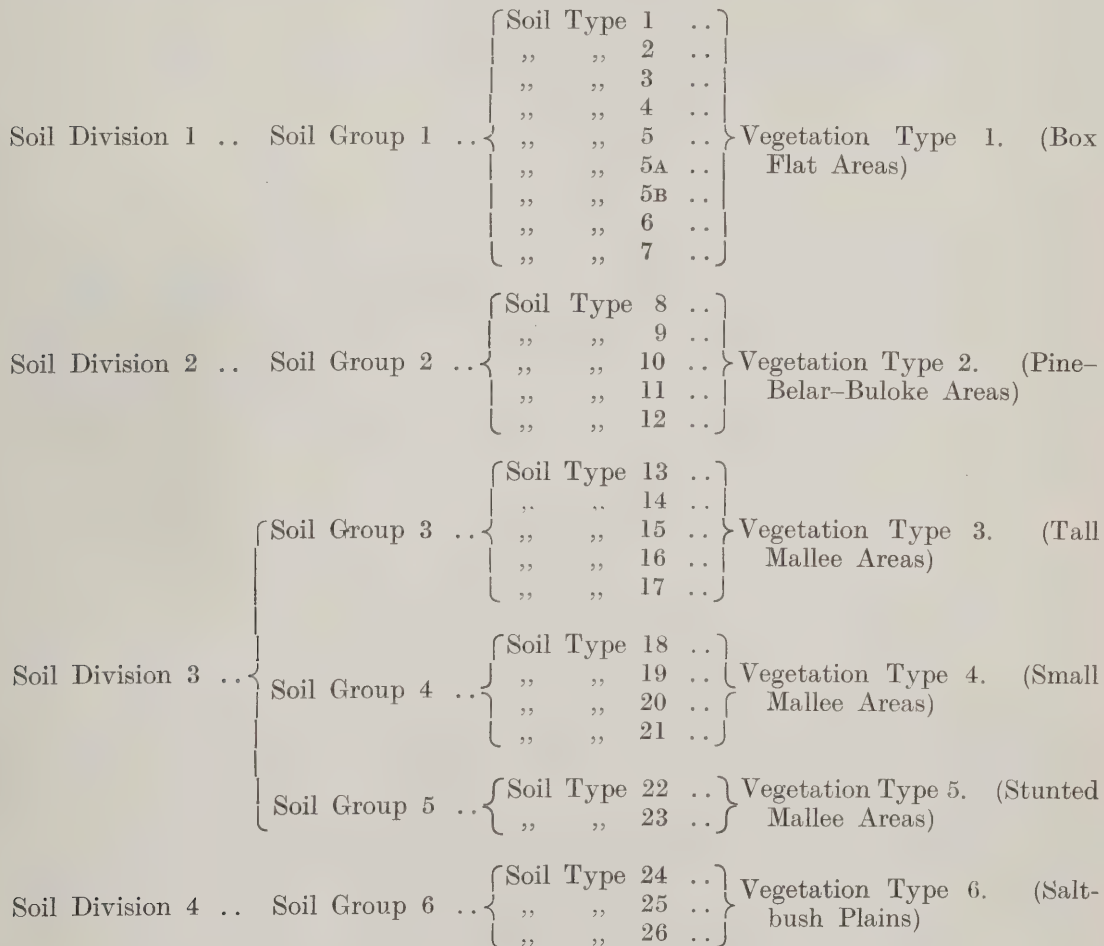

Soil Division 1 .. Soil Group 1 .. Soil Type 1 .. ,, ,, 2 .. ,, ,, 3 .. ,, ,, 4 .. ,, ,, 5 .. ,, ,, 5A .. ,, ,, 5B .. ,, ,, 6 .. ,, ,, 7 .. Vegetation Type 1. (Box Flat Areas)
Soil Division 2 .. Soil Group 2 .. Soil Type 8 .. ,, ,, 9 .. ,, ,, 10 .. ,, ,, 11 .. ,, ,, 12 .. Vegetation Type 2. (Pine–Belar–Buloke Areas)
Soil Division 3 .. Soil Group 3 .. Soil Type 13 .. ,, ,, 14 .. ,, ,, 15 .. ,, ,, 16 .. ,, ,, 17 .. Vegetation Type 3. (Tall Mallee Areas)
Soil Group 4 .. Soil Type 18 .. ,, ,, 19 .. ,, ,, 20 .. ,, ,, 21 .. Vegetation Type 4. (Small Mallee Areas)
Soil Group 5 .. Soil Type 22 .. ,, ,, 23 .. Vegetation Type 5. (Stunted Mallee Areas)
Soil Division 4 .. Soil Group 6 .. Soil Type 24 .. ,, ,, 25 .. ,, ,, 26 .. Vegetation Type 6. (Salt-bush Plains)

Fig. 12.

(Vegetation Type 1) are commonly interrupted by belts of *Callitris robusta*, *Callitris propinqua*, *Casuarina Leuhmanni* and associated plants (Vegetation Type 2). Small Mallee Areas (Vegetation Type 4) also occur in a similar manner. The appearance of vegetation belonging to Types 2 and 4 within the boundaries of Vegetation Type 1 is not due to any change in rainfall, but to different soil conditions. The soils of Vegetation Types 2 and 4 are confined to levels above the reach of flood waters from the Murray River. Similarly, patches of Vegetation Types 3 and 4 are found within large areas of Vegetation Type 2; Vegetation Types 2 and 4 within Vegetation Type 3; Vegetation Type 3 within Vegetation Type 4; and in Vegetation Type 5, isolated small areas of Vegetation Types 2, 3, and 4 occur. These changes of vegetation are the result of soil alteration.

The relationship between soils and vegetation is diagrammatically illustrated in Fig. 12.

Table 10 shows percentage by species of trees, shrubs or semi-shrubs, and smaller plants occurring in the various soil groups.

Table 10.

Soil Group.	Trees.	Shrubs or Semi-shrubs.	Smaller Plants (often seasonal).
	%	%	%
1	23	19	58
2	28	48	24
3	21	38	41
4	16	47	37
5	..	77	23

The percentage figures shown in Table 10 are an estimate arrived at by a census taken of native plants by species occurring in each soil group, and these may be considered to furnish a fair general average. The families *Gramineae*, *Loranthaceae*, *Chenopodiaceae* (with the exception of *Chenopodium nitrariaceum*), *Lauraceae*, *Marsiliaceae*, *Cyperaceae*, and *Juncaceae* have not been considered in the percentage tabulation, the plants occurring in these families being listed under the column marked "others" elsewhere (Group 4 in Tables). Soil Group 6 (Salt-bush Plains) is not included.

TABLE 11.

Showing the order taken by each Soil Group in relation to percentage by species of trees, shrubs, or semi-shrubs, and smaller plants (often seasonal).

Trees.		Shrubs or Semi-shrubs.		Smaller Plants (often seasonal).	
	%		%		%
Soil Group 2	28	Soil Group 5	77	Soil Group 1	58
,, ,, 1	23	,, ,, 2	48	,, ,, 3	41
,, ,, 3	21	,, ,, 4	47	,, ,, 4	37
,, ,, 4	16	,, ,, 3	38	,, ,, 2	24
,, ,, 5	0	,, ,, 1	19	,, ,, 5	23

COLUMN 1 (TREES).

Table 11 presents some interesting comparisons. Taking as a basis percentage tabulation according to the presence of trees, shrubs or semi-shrubs or smaller plants by species, it is found that in the "Tree" column the first place is taken by soils belonging to Group 2, with a gradual falling away of percentage through soils of Group 1, Group 3, and Group 4, and the tree growth ceases altogether with the entry to the arid sands of Soil Group 5. The order taken by the soils is according to expectation, and shows as a general rule that the tree growth becomes less and less as the soils change from heavy types to extremely sandy ones.

COLUMN 2 (SHRUBS OR SEMI-SHRUBS).

The soils of Group 5 support the highest percentage of shrubs and semi-shrubs. Group 2 and Group 4 soils are close in percentage, and shrub growth falls away in soils belonging to Group 3, leaving Group 1 soils in the lowest place. It must, however, be remembered that the soils of Group 5 support certain species in shrub form which occur in other soil groups as trees, i.e., *Eucalyptus incrassata*, *Eucalyptus oleosa*, *Eucalyptus dumosa*, *Eucalyptus viridis*, *Fusanus persicarius*, and *Callitris verrucosa*. The reduction from the tree to shrub state is due to poorer soils, which conclusion has been proved by the occurrence of these particular species as trees in somewhat better soil conditions.

It would appear that the presence of a low percentage of shrub species in Group 1 soils is due more to the inability of low growths to withstand immersion from flood waters than to the unsuitability of soil conditions. Even seedlings of *Eucalyptus rostrata* and *Eucalyptus bicolor*, typical Box Flat trees, cannot withstand complete immersion.

Column 3 (Smaller Plants—Often Seasonal).

In column 3, the highest percentage is taken by soils of Group 1, Groups 3 and 4 are near each other, followed by Group 2, and finally come the soils of Group 5.

The damper condition of soils of Group 1 permits a high percentage of this type of growth, soil conditions are agreeable, and water is usually much more plentiful.

Soil Groups 3 and 4 are fairly close in percentage, but Group 2 drops away. It has been noticed that in Pine–Belar areas the growth of small plants is limited. The main causes of this are apparently—

(*a*) surface feeding roots of Pine–Belar, and

(*b*) fairly close overhead canopy in Pine–Belar.

In good years, open spaces in this class of country (Soil Type 12) are heavily covered with grasses, principally *Stipa spp.* and *Danthonia spp.*, whereas few, if any, of the grasses occur under stands of Pine–Belar.

Largely on account of poor soil conditions and a lack of moisture attributable to the great depth of sand, the soils of Group 5 would not be expected to support a large percentage of small herbaceous to scarcely woody plants. The ground space between the low-branching " Mallee " species (*Eucalyptus*) and other shrubs is mostly occupied by *Triodia irritans.*

THE OCCURRENCE OF THE SAME SPECIES IN MORE THAN ONE SOIL GROUP

Table 12 shows the occurrence of the same trees, shrubs and smaller plants in more than one Soil Group.

Included in Box Flat areas are 16 species of trees, 16 species of shrubs, and 72 species of smaller plants. Grasses, rushes, salt-bushes, and parasites are not included in this table but are shown in Tables 2, 4, 6, and 8.

Of the 16 species of trees found in Box Flat areas (Soil Group 1), 6 also occur in Soil Group 2, 7 in Group 3, and 2 in Group 4. None extend to Groups 5 and 6. Similarly, the occurrence of " Box Flat " shrubs and smaller plants in other soil groups is shown, together with like data for each vegetation type indicated accordingly.

Although there seems to be a tendency on the part of the vegetation of some types to extend more to one or two soil groups than to the others, a good deal of caution and investigation is necessary before definite conclusions can be formed for the reason of this extension. Assuming that soil groups having the most affinity should show a greater number of the same species of plants occurring thereon, certain factors come into play which can upset this assumption. The ease with which some plants adapt themselves to changing soil conditions is important, and a vegetation type containing a large number of such plants could show a considerable extension of species to other soil groups. This in itself would not necessarily show affinity of soils, but might perhaps be due to plant adaptability. On the other hand, difficult seed dispersal may prove an important factor in preventing plants from spreading from

one soil group to another. Some plants may have heavy seeds which fall to the ground and remain there. Others with seeds easily carried long distance by wind, birds or animals and distributed far away in different soils have at least an opportunity to germinate. Some species of course establish themselves and others fail to do so. It is therefore possible for a plant having heavy seeds not easily transportable by birds or animals (and by wind not at all) to lack ready opportunity for establishing itself in other soils. The difficulty of dispersal in this case is perhaps the important factor rather than the inability of the plant to adapt itself to other soils. Extension under these circumstances would be extremely slow.

The rare appearance of *Fusanus acuminatus* on Box flats is an illustration which may be due to difficult seed distribution, the chief agency in such distribution being emus, which are fond of the fruits. The birds eat the fruits where the tree is most commonly found (Soil Groups 2 and 3) and drop the indigested seeds on soils belonging to these groups. Occasionally a bird may drop the seeds on the further removed soils of Group 1, where this tree has been observed growing strongly. Further, although surface soil conditions may be sufficiently alike to invite a large extension of small plants only developing a shallow root system, subsoil horizons can easily be so dissimilar that any ready extension of trees which root deeply may be prevented.

Areas subject to flooding (Vegetation Type 1) do not support " Mallee " trees such as *Eucalyptus oleosa*, *Eucalyptus dumosa*, and *Eucalyptus viridis*, and trees which depend on intermittent flooding (*Eucalyptus rostrata* and *E. bicolor*) do not extend to dry areas. This special regard for conditions indicates a class of vegetation which cannot adapt itself to extreme variation, and the fact that *Eucalyptus rostrata* and *Eucalyptus bicolor* do not extend to dry areas, combined with the non-appearance of " Mallee " eucalypts on Box Flat areas, is a good illustration of this lack of adaptability. The " Mallee " eucalypts show considerable ability in adopting other soils in their extension from the soils of Group 3 to soils of Groups 4 and 5 where, however, a reduction from the tree state to the shrub form (Vegetation Type 5) indicates an approach to the limit of extension.

TABLE 12.—THE OCCURRENCE OF THE SAME SPECIES IN MORE THAN ONE SOIL GROUP. Plants in Group 4 ("others") not included (see Tables 2, 4, 6, and 8).

Vegetation Type.	Nature of Vegetation.	No. of Species.	Soil Group—					
			1.	2.	3.	4.	5.	6.
Vegetation Type 1 (Box Flat Areas)	Trees ..	16	..	6	7	2	..	..
	Shrubs ..	16	..	2	4	..	..	..
	Smaller Plants	72	..	5	14	5	1	4
Vegetation Type 2 (Pine–Belar Areas)	Trees ..	11	5	..	6	4	..	..
	Shrubs ..	23	2	..	16	7	1	..
	Smaller Plants	13	2	..	6	4	2	1
Vegetation Type 3 (Tall Mallee Areas)	Trees ..	15	7	7	10	10	4*	2
	Shrubs ..	29	3	16	..	11	1	1
	Smaller Plants	47	9	4	..	22	3	8
Vegetation Type 4 (Small Mallee Areas)	Trees ..	14	2	4	10	..	7*	2
	Shrubs ..	39	..	7	11	..	8	..
	Smaller Plants	54	2	1	20	..	5	4
Vegetation Type 5 (Stunted Mallee Areas)	Trees ..	8*	..	..	4	7	..	1
	Shrubs ..	18	..	1	1	8	..	..
	Smaller Plants	9	1	1	3	5	..	..
Vegetation Type 6 (Salt-bush Plains)	Trees ..	3	..	1	2	2	1*	..
	Shrubs ..	1	..	1	1	..	..	..
	Smaller Plants	34	4	3	9	5	..	..

* Trees reduced to shrubs.

PLANTS AS SOIL INDICATORS

Of the several soil groups previously specified, it is interesting to note that, while many species occur on more than one group, certain species are rigidly confined to one. Definite lines of natural demarcation in this respect are readily discernible, particularly in soil types of marked divergence. Soils of Group 1 are bordered by soils of Groups 2, 3, and 4. The appearance of *Leptospermum coriaceum* and *Eucalyptus incrassata* on sandy rises adjoining typical *Eucalyptus bicolor* country is only one of many instances of varying plant indication.

Where land has been cleared of all native vegetation during the progress of settlement, a method of grouping plants which are recognized as appearing in certain soil groups indicates the species comprising the original flora. Perhaps it is necessary to include species which are known to appear in more than one soil group. Likewise, from the aspect of settlement, a study of the flora gives a clear indication of the suitability of soils for cultivation.

Regarding the area under discussion, observation has shown that the plants numerically distinguished in the List of Indigenous Plants at the end of this work (see List of Indigenous Plants for interpretation) appear to be the chief species confined to one separate soil group, where they grow intermixed with other species which occur in more than one soil group.

In considering vegetation as an indicator of soils, a general knowledge of the groupings of plants likely to occur in more than one soil group, together with those plants confined to a single soil group, is required to form an accurate impression. The number of those species occurring in more than one group is considerable and, in comparison, those plants confined to one particular group are sometimes fairly limited.

The reduction from tree to shrub form is also a useful indication of soil value where the following species are concerned, viz., *Eucalyptus oleosa*, *Eucalyptus incrassata*, *Eucalyptus dumosa*, *Eucalyptus viridis*, *Callitris verrucosa* and *Myoporum platycarpum*.

The appearance of *Triodia irritans* immediately denotes a soil which is liable to bad drift if cleared. *Nitraria Schoberi* indicates the presence of some salt, and *Arthrocnemum halocnemoides* signifies extremely saline conditions.

THE RETURN OF VEGETATION ON PROTECTED AREAS

From time to time some opinions have been expressed doubting the ability of the native flora to re-establish itself in areas which have been cleared. Observation has definitely shown these opinions to be erroneous and it can be safely stated that when the vegetation has been given a proper opportunity this ability is beyond question. Factors militating against the successful regeneration of the major portion of the native flora are firstly lack of protection from grazing and rabbits, and secondly the insufficiency of rainfall. In good seasons, however, the response of the vegetation is marvellous, and providing little damage is suffered from the ravages of rabbits and stock, a very successful regeneration of most species takes place. Under these conditions in a year of good rainfall, most of the indigenous flora responds well and, once established, rapidly clothes the area with a vigorous growth.

A mutilated stand of Murray Pine. Trees were felled many years ago to feed starving stock.

THE EFFECT OF SETTLEMENT ON VEGETATION AND SOILS

(1) VEGETATION.

(*a*) Isolation.

(*b*) Possible extinction by clearing and grazing.

Extensive opening up of large belts of timber by clearing for the production of wheat has had a marked effect on the genus *Callitris*. These trees will not tolerate isolation after years of protection, and whenever they are faced with extreme exposure they soon die. It is believed that the more rapid air current passing through the foliage caused by the removal of former wind obstruction in the way of vegetation promotes an unusually rapid rate of transpiration. Consequently the tree, being unaccustomed to this changed state, cannot adapt itself quickly enough to survive. In support of this theory, it is observed that Native Pine growing in situations receiving regular irrigation, as in the Mildura settlement, withstands isolation. No doubt this is due to the plentiful supply of soil moisture always on hand.

Owing partly to the inroads made by man in his desire to clear more and yet more land for cultivation, and partly to continual grazing, many plants which were common when this part of the State was virgin country are now becoming uncommon and sometimes rare. The following plants may be regarded as uncommon : *Hakea flexilis*,* *Grevillea pterosperma*,* *Exocarpus spartea*,* *Exocarpus stricta*,* *Marsdenia australis*, *Eremophila Sturtii*, *Eremophila scoparia*, *Eremophila bignoniiflora*, *Myoporum montanum*, *Myoporum parvifolium*,* *Dodonaea stenozyga*,* *Leptomeria aphylla*, *Halorrhagis odontocarpa*,* *Melothria micrantha*,* *Cryptandra amara*,* *Melaleuca halmaturorum*,* *Baeckea Behrii*,* *Codonocarpus cotinifolius*, *Lepidium leptopetalum*, *Blennodia trisecta*, *Billardiera cymosa*.* *Eutaxia microphylla*, *Bertya Mitchellii*, *Olearia teretifolia*,* *Tricoryne elatior*,* *Baeckea crassifolia*,* and *Hybanthus floribundus*.*

These plants are rare : *Gahnia lanigera*,* *Thysanotus Baueri*,* *Pterostylis rufa*, *Casuarina Muelleriana*,* *Trichinium nobile*, *Cassinia arcuata*,* *Pimelea microcephala*,* *Gyrostemon australasicus*,* *Phyllanthus lacunarius*,* *Templetonia sulcata*, *Anthocercis myosotidea*,* *Senecio platylepis*,* *Asperula gemella*, *Caladenia dilatata*,* *Calostemma purpureum*,* *Acacia acanthoclada*,* *Swainsona Greyana*, *Swainsona laxa*, *Bredemeyera scoparium*,* *Plagianthus Berthae*, *Didiscus cyanopetalus*, *Eremophila polyclada*, *Eremophila crassifolia*,* *Alternanthera nodiflora*, *Bursaria spinosa*, *Lasiopetalum Baueri*,* *Abutilon Theophrasti*,* *Solanum lacunarium*,* *Jasminum lineare*, *Pterostylis cycnocephala*,* *Pterostylis concinna*,* *Ceratogyne obionoides*, *Myoporum deserti*, and *Olearia subspicata*.

However, the foregoing species can be divided into two sections :—

(1) those species likely to survive the progress of settlement and grazing, indicated above by * ; and

(2) those species which are likely to become extinct.

Those plants likely to survive occur on land which is not suitable for cultivation or which is not liable to be over-grazed. On the other hand, those plants likely to become extinct must contend with clearing, grazing, and rabbits, the latter doing much to kill out certain species, e.g., *Codonocarpus cotinifolius*, *Marsdenia australis*, and *Myoporum montanum*, the bark and foliage of which is particularly palatable to them.

Trichinium nobile, *Eremophila bignoniiflora*, and *Eremophila polyclada*, *Swainsona Greyana*, *Swainsona laxa*, and *Myoporum deserti* are already extremely rare and do not appear to be able to withstand continual grazing. *Swainsona Greyana* multiplied during the flood of 1931 and several thousand plants appeared in three separate adjacent areas on the Potterwakagee Creek, in the Wool Woola Crown Lands. This increase was due to inaccessibility through flooding, so that sheep and rabbits were unable to eat off the seedling plants which appeared. *Lepidium leptopetalum*, *Blennodia trisecta*, *Eutaxia microphylla*, *Bertya Mitchellii*, and *Eremophila scoparia* are rapidly becoming rarer as more land is cleared for cultivation.

(2) SOIL EROSION.

Two kinds of soil erosion take place, i.e.,

(1) Soil erosion by water.

(2) Soil erosion by wind—

(*a*) Windswept plains.

(*b*) Sand drift.

Sand drift.

Prior to the interference with the native vegetation, soil erosion was negligible, but recent years have brought a change. This change may be ascribed to the indiscriminate clearing of large tracts of country for settlement, excessive overstocking of land with sheep, and the prevalence of the destructive rabbit.

Soil Erosion by Water.

This may be considered as the minor type of erosion. Typical examples are common along the banks of the Murray River and are due mainly to the occasional extreme floods which come down the river, as the normal height and rate of flow is not conducive to rapid erosion. Lesser examples are found in the wind-swept Salt-bush Plains (Vegetation Type 6) where wind action has caused the native plants, chiefly *Kochia* and *Atriplex*, to die out and channels have been cut out in soils

originally clothed with ample cover of the family *Chenopodiaceae.* This state of affairs is due to overstocking with sheep without due regard to the propagation of the natural ground flora by seedlings.

Soil Erosion by Wind.

(*a*) *Windswept Plains.*

These plains cover some thousands of acres in the far north-western corner of the State, and are situated between the Murray flats on the north and the Mallee and Pine–Belar rises on the west, south and east. Smaller areas of similar country appear throughout the north-west, but they are sheltered by timbered belts. They do not suffer seriously from wind erosion.

Before the advent of the white man, this class of country was probably free from any serious soil erosion. Sheep grazing was introduced and persisted in without thought as to the conservation of sufficient ground flora to insure protection for the surface soil horizon. Overstocking has reduced the original vegetation to a minimum, thus allowing strong winds to sweep away the light surface soil from between the remaining clumps of plants. The existing vegetation has not been allowed to flower and seed freely, and in years of drought, or even good years, sheep and rabbits eat practically all the seeds dropped to the ground. Thus regeneration is prevented.

This wind sweeping exercises a very adverse effect on the present growth, and also removes the natural seed bed for the regeneration of the seeds dropped. Plants left to struggle on small mounds cannot be expected to survive long; rain, when it falls, is not readily absorbed equally over the surface, but runs off the hard exposed subsoil and accumulates at the lowest levels. Here it remains for lengthy periods unabsorbed and much is lost by evaporation. Before wind sweeping occurred, an equal and full absorption took place, benefiting greatly the plants in possession of this type of country, and seedling regeneration naturally followed.

(*b*) *Sand Drift.*

This presents the major problem of soil erosion and has been caused by—

(1) excessive clearing of large belts of natural cover;
(2) selection of soils for agricultural purposes without proper regard to their drifting propensities;
(3) insufficiency of wind-breaks of native vegetation; and
(4) lack of sufficient rainfall.

Most Mallee soils when devoid of vegetation suffer from wind erosion. The greater the depth of surface sands, the greater is the degree of drift, and light soils with a sandy loam surface horizon do not altogether escape. The soils belonging to Group 1 are made up of types which generally are not susceptible to wind action. However, in this Group, Types 1 and 2 do drift seriously when cleared. In soils of Groups 2 and 3, there is sufficient sand in the surface horizons of most types to make them much more dangerous than those soils belonging to Group 1. Soil Type 8 drifts badly. It is, however, chiefly the sandy soils of Groups 4 and 5 which have demonstrated the undesirability of removing the vegetation. Composed of considerable depths of incoherent sands, these soils are at the mercy of the winds whenever dry periods preclude the growth of crops or herbage.

Removal of vegetation has resulted in serious soil erosion. The lady's head is at the level of the original soil surface.

Roads are becoming impassable due to accumulation of drifting sand.

A badly eroded sand hill. Original vegetation stunted Mallee.

It must be recognized that every plant from the largest of trees, viz., *Eucalyptus rostrata*, *Eucalyptus bicolor*, *Callitris robusta*, *Callitris propinqua*, *Casuarina lepidophloia*, and *Casuarina Luehmannii*, down to the smallest such as *Podosperma angustifolia*, *Myriocephalus Stuartii*, and *Didiscus cyanopetalus* plays a most important part in the holding of soils against drift. High belts of timber weaken the force of the wind, and shrub forms of vegetation further reduce its velocity, until the low ground flora is quite strong enough to contend with the reduced wind strength at ground level.

Poorer sands encroaching on interdune valley.

By virtue of a gradual process of evolution, the various soils have been provided with a flora particularly adapted to withstand the elements. This is evidenced by a consideration of the vegetation of each type. Those soils less liable to drift carry generally a taller kind of vegetation with a lower percentage of shrub growths, whereas soils which will easily drift are densely clothed with low species. The reduction of trees to shrubby growths is an adaptation compelled by nature.

Eucalyptus oleosa, *Eucalyptus incrassata*, *Eucalyptus dumosa*, and *Eucalyptus viridis* are reduced when they occur in the Stunted Mallee areas. Here the ground is densely covered with *Triodia irritans*, one of the grasses that is a certain guide to soils which, in a cleared state, drift badly.

The effects of wind on sandy rises. Shrubs are *Leptospermum coriaceum*.

Smaller plants having only a short period of activity actually do much in holding sandy country, but when rainfall has not been sufficient to germinate and maintain these plants through their short life, drift soon sets in and continues until the next seasonal growth. One of the most useful plants in this respect is *Myriocephalus Stuartii*, which regularly clothes most open sandy rises when rainfall is sufficient. Other particularly useful small plants are: *Helichrysum apiculatum*, *Craspedia uniflora*, *Helipterum anthemoides*, *Helipterum variabile*, *Gnaphalium luteoalbum*, *Waitzia acuminata*, *Millotia tenuifolia*, *Podosperma angustifolia*, *Amphipogon strictus*, *Trichinium exaltatum*, *Ajuga australis*, *Nicotiana suaveolens*, *Vittadinia triloba*, *Pelargonium australe*, *Daucus glochidiatus*, *Didiscus cyanopetalus*, *Calotis erinacea*, *Lomandra leucocephala*, *Gahnia lanigera*, *Lepidosperma concavum*, *Loudonia Behrii*, *Stipa spp.*, and *Triodia irritans*.

Myriocephalus Stuartii holds the sandy soils of open rises in the Mallee.

Numerous low shrubby plants of a more permanent nature have been allotted the part of assisting in the establishment of the smaller plant growth. In sufficiently rainy seasons this assistance takes the form of shelter given to the plant growth and the loose sandy soil. Among the most important of these shelter plants are *Cassia eremophila*, *Cassia Sturtii*, *Grevillea pterosperma*, *Grevillea ilicifolium*, *Acacia obliqua*, *Acacia microcarpa*, *Beyeria Leschenaultii*, *Dodonaea bursariifolia*, *Dodonaea stenozyga*, *Dodonaea attenuata*, *Melaleuca acuminata*, *Leptospermum coriaceum*, *Acacia ligulata*, *Acacia hakeoides*, *Acacia colletioides*, *Acacia rigens*, *Acacia acanthoclada*, *Acacia sclerophylla*, *Phebalium glandulosum*, *Beyeria opaca*, *Halgania cyanea*, *Prostanthera chlorantha*, *Eremophila glabra*, *Olearia rudis*, *Olearia Muelleri*, *Olearia teretifolia*, *Olearia subspicata*, and *Hibbertia stricta*.

As already mentioned, certain trees are reduced to useful shrub form in arid sandy areas.

The lower canopies are sheltered by the taller trees which occupy the better soils.

It may be said that the removal of vegetation has disturbed the balance of nature to a disastrous extent. In dry years, sand drift is a distinct menace to the far north-west of Victoria, and it is a problem which will have to be faced sooner or later.

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LIST OF INDIGENOUS PLANTS WHICH HAVE BEEN FOUND GROWING IN THE AREA UNDER DISCUSSION

(Those plants confined to a particular soil group are indicated by a number following the species. 1 = Soil Group 1, 2 = Soil Group 2, and so on.)

Salvinaceae—
Azolla filiculoides var rubra .. .. .. Red Azolla

Marsiliaceae—
Marsilia Drummondii .. .. .. Nardoo
Marsilia hirsuta .. .. Short-fruit Nardoo

Pinoideae—
Callitris robusta[2] .. .. Murray Pine
Callitris verrucosa .. .. Scrub Pine
Callitris propinqua[2] .. .. Slender Pine

Typhaceae—
Typha angustifolia .. .. Bulrush

Potamogetonaceae—
Potamogeton sulcata .. .. Furrowed Pondweed

Juncaginaceae—
Triglochin calcitrapa[3] .. .. Spurred Arrowgrass
Triglochin procera var dubium .. .. Water Ribbons

Alismataceae—
Damasonium minus .. .. Starfruit

Hydrocharitaceae—
Vallisneria spiralis .. .. Eel-grass
Ottelia ovalifolia .. .. Swamp Lily

Gramineae—
(Andropogoneae)—
Pollinia fulva .. .. Brown Top
(Zoysieae)—
Tragus racemosus .. .. .. Small Burr Grass
(Paniceae)—
Paspalidium gracile .. .. .. Graceful Panic Grass
Panicum decompositum .. .. .. Native Millet
Panicum effusum .. .. .. Hairy Panic Grass
Panicum prolutum .. .. .. Pallid Panic Grass
Digitaria divaricatissima .. .. .. Spider Panic Grass
Eriochloa punctata .. .. .. Plain Grass
Chamaeraphis spinescens .. .. .. Spiny Mud Grass

(Festuceae)—

Pappophorum nigricans	Niggerheads
Poa caespitosa	Tussock Grass
Poa Drummondiana	Knotted Meadow Grass
Poa lepida	Scaly Meadow Grass
Triodia irritans	Porcupine Grass or Spinifex
Eragrostis diandra	Close-headed Love Grass
Eragrostis Dielsii	Mallee Love Grass
Eragrostis Brownii	Common Love Grass
Eragrostis setifolia	Bristly Love Grass
Eragrostis falcata	Sickle Love Grass
Glyceria ramigera	Bamboo Grass
Bromus arenarius	Sand Brome
Amphipogon strictus	Grey-beard Grass
Phragmites communis	Common Reed Grass

(Agrostideae)—

Stipa scabra	Rough Spear Grass
Stipa elegantissima	Feather Spear Grass
Stipa eremophila	Desert Spear Grass
Stipa semibarbata	Fibrous Spear Grass
Stipa mollis	Soft Spear Grass
Stipa acrociliata	Graceful Spear Grass
Stipa platychaeta	Flat-awned Spear Grass
Stipa Drummondii	Cottony Spear Grass
Stipa variabilis	Variable Spear Grass
Alopecurus geniculatus	Marsh Foxtail Grass
Calamagrostis filiformis	Blown Grass
Aristida arenaria	Sand Spear Grass
Sporobolus virginicus	Coast Rat-tail Grass

(Chlorideae)—

Chloris truncata	Windmill Grass
Chloris acicularis	Spider Grass
Cynodon Dactylon	Couch Grass

(Aveneae)—

Danthonia semiannularis	Wallaby Grass
Amphibromus nervosus	Swamp Wallaby Grass

(Hordeae)—

Lepturus incurvatus	Coast Barb Grass

Cyperaceae—

Cyperus vaginatus	Stiff Leaf Rush
Cyperus difformis	Variable Leaf Rush
Cyperus Gunnii	Flecked Leaf Rush
Cyperus pygmaeus	Dwarf Leaf Rush
Lipocarpha microcephala	Button Rush
Gahnia lanigera[4]	Little Sedge

Lepidosperma concavum[4]	Hill Sword Sedge
Fimbristylis squarrosa	Veiled Fringe Rush
Fimbristylis aestivalis	Summer Fringe Rush
Scirpus inundatus	Swamp Club Rush
Scirpus supinus	Soft Club Rush
Schoenus aphyllus	Leafless Bog-rush
Heleocharis acicularis	Small Spike Rush
Carex pumila	Spreading Sedge
Juncaceae—	
Juncus pauciflorus	Loose-flower Rush
Juncus bufonius	Toad Rush
Liliaceae—	
Thysanotus Baueri[5]	Mallee Fringe Lily
Thysanotus Patersonii	Twining Fringe Lily
Thysanotus tuberosus	Common Fringe Lily
Anguillaria dioica	Early Nancy
Bulbine semibarbata	Leek Lily
Dianella revoluta	Spreading Flax Lily
Lomandra leucocephala[4]	White Mat Rush
Tricoryne elatior[4]	Yellow Autumn Lily
Dianella laevis	Smooth Flax Lily
Amaryllidaceae—	
Crinum flaccidum[1]	Murray Lily
Calostemma purpureum[1]	Garland Lily
Hypoxis glabella	Yellow Star
Orchidaceae—	
Pterostylis rufa[2]	Rustyhood
Pterostylis cycnocephala[4]	Swan Greenhood
Pterostylis mutica	Midget Greenhood
Pterostylis concinna[5]	Trim Greenhood
Caladenia dilatata[3]	Fringed Spider Orchid
Casuarinaceae—	
Casuarina lepidophloia[2]	Belar
Casuarina Luehmannii[2]	Buloke
Casuarina Muelleriana[5]	Slaty Sheoke
Urticaceae—	
Parietaria debilis	Forest Pellitory
Proteaceae—	
Hakea vittata	Striped Hakea
Hakea leucoptera	Needlewood
Hakea ulicina	Furze Needlewood
Hakea flexilis[5]	Flexile Hakea
Grevillea Huegelii	Comb Grevillea
Grevillea ilicifolia[5]	Holly Grevillea
Grevillea pterosperma	Desert Grevillea

Santalaceae—

Exocarpus spartea	Broom Ballart
Exocarpus stricta	Pale-fruit Ballart
Exocarpus aphylla	Leafless Ballart
Fusanus persicarius	Bitter Quandong
Fusanus acuminatus	Sweet Quandong
Leptomeria aphylla[3]	Leafless Currant Bush

Loranthaceae—

Loranthus linophyllus	Slender Mistletoe
Loranthus Preissii	Wire-leaf Mistletoe
Loranthus Miquelii	Stalked Mistletoe
Loranthus exocarpi	Harlequin Mistletoe
Loranthus miraculosus var Boormanii	Round-leaf Mistletoe
Loranthus pendulus	Drooping Mistletoe

Polygonaceae—

Muehlenbeckia Cunninghamii[1]	Tangled Lignum
Muehlenbeckia diclina	Slender Lignum
Polygonum lapathifolium	Pale Knotweed
Polygonum plebeium	Small Knotweed
Rumex crystallinus[1]	Glistening Dock

Chenopodianeae—

Salsola Kali	Roly Poly
Kochia tomentosa	Silky Bluebush
Kochia triptera	Three-winged Bluebush
Kochia triptera var pentaptera	Three-winged Bluebush
Kochia appressa	Cottony Bluebush
Kochia brevifolia	Short-leaf Bluebush
Kochia pyramidata	Shrubby Bluebush
Kochia villosa	Low Bluebush
Kochia aphylla	Leafless Bluebush
Kochia oppositifolia	Opposite-leaf Bluebush
Kochia sedifolia	Dense Bluebush
Bassia paradoxa	Curious Saltbush
Bassia tricuspis	Three-spined Saltbush
Bassia uniflora	Two-spined Saltbush
Bassia patenticuspis	Spear-fruit Saltbush
Bassia sclerolaenoides	Woolly-fruit Saltbush
Bassia quinquecuspis	Five-spined Saltbush
Bassia parviflora	Prickly-fruit Saltbush
Bassia biflora	Twin-flower Saltbush
Atriplex Muelleri	Lagoon Saltbush
Atriplex angulatum	Angular Saltbush
Atriplex halimoides	Dwarf Saltbush
Atriplex semibaccatum	Berry Saltbush
Atriplex nummularium	Old-man Saltbush
Atriplex rhagodioides	Silver Saltbush
Atriplex campanulatum	Bell Saltbush

Atriplex stipitatum	Kidney Saltbush
Atriplex limbatum	Spreading Saltbush
Atriplex leptocarpum	Slender-fruit Saltbush
Atriplex vesicarium	Bladder Saltbush
Atriplex spongiosum	Spongy Saltbush
*Atriplex halimoides var. conduplicatum**	Dwarf Saltbush
Rhagodia crassifolia	Fleshy Saltbush
Rhagodia nutans	Nodding Saltbush
Rhagodia Gaudichaudiana	Cottony Saltbush
Rhagodia hastata	Saloop Saltbush
Rhagodia spinescens	Thorny Saltbush
Chenolea tricornis	Three-horned Saltbush
Chenolea pentagona	Slender Bluebush
Chenolea stelligera	Starred Bluebush
Chenolea brachyptera	Woolly Bluebush
Chenopodium nitrariaceum[1]	Branching Goosefoot
Chenopodium microphyllum	Small-leaf Goosefoot
Chenopodium atriplicinum	Purple Goosefoot
Chenopodium album	Red Goosefoot Fat Hen
Chenopodium carinatum	Keeled Goosefoot
Chenopodium cristatum	Crested Goosefoot
Enchylaena tomentosa	Barrier Saltbush
Salicornia australis[6]	Beaded Glasswort
*Salicornia Lylei**	Frail Glasswort
Arthrocnemum halocnemoides[6]	Shrubby Glasswort
Arthrocnemum leiostachyum	Smooth-spike Glasswort
Arthrocnemum halocnemoides var. pergranulatum	Shrubby Glasswort
Thelkeldia salsuginosa	Bone-fruit Saltbush
Pachycornia triandra[6]	Desert Glasswort
*Pachycornia tenuis**	Small Glasswort
Dysphania littoralis	Pigweed
Amaranthaceae—	
Trichinium spathulatum	Pussy-tails
Trichinium exaltatum	Lamb-tails
Trichinium nobile[6]	Yellow-tails
Trichinium obovatum	Silver-tails
Trichinium alopecuroideum	Long-tails
Alternanthera nodiflora[1]	Common Joyweed
Alternanthera denticulata[1]	Joyweed
Phytolaccaceae—	
Codonocarpus cotinifolius[4]	Bell-fruit
Gyrostemon australasicus[5]	Wheel-fruit
Aizoaceae—	
Mesembrianthemum australe	Rounded Pigface
Glinus Spergula[1]	Curled Carpet-weed
Glinus lotoides[1]	Hairy Carpet-weed

* Not previously recorded for Victoria.

Portulacaceae—	
Calandrinia calyptrata	Pink Purslane
Calandrinia corrigioloides[4]	Strap Purslane
Caryophyllaceae—	
Spergularia rubra[1]	Sandspurry
Scleranthus minusculus	Cushion Knawel
Ranunculaceae—	
Clematis microphylla	Small-leaved Clematis
Myosurus minimus[1]	Mousetail
Ranunculus parviflorus var glabrescens	Small-flowered Buttercup
Lauraceae—	
Cassytha melantha	Large Dodder-laurel
Cruciferae—	
Lepidium leptopetalum	Slender Pepper Cress
Lepidium hyssopifolium[1]	Rubble Pepper Cress
Lepidium papillosum[1]	Warty Pepper Cress
Lepidium fasciculatum[1]	Bundled Pepper Cress
Blennodia trisecta[3]	Woody Cress
Blennodia lasiocarpa[2]	Hairy Cress
Blennodia cardaminoides[1]	Sand Cress
Hutchinsia procumbens	Oval Shepherd's Purse
Cardamine laciniata[1]	Jagged Bitter Cress
Stenopetalum lineare	Narrow Thread Petal
Stenopetalum sphaerocarpum	Pea Thread Petal
Pittosporaceae—	
Billardiera cymosa[5]	Sweet Apple-berry
Pittosporum phillyreoides	Weeping Pittosporum
Bursaria spinosa[4]	Sweet Bursaria
Geraniaceae—	
Pelargonium australe	Austral Storksbill
Erodium cygnorum	Blue Heronsbill
Oxalidaceae—	
Oxalis corniculata	Yellow Wood Sorrel
Zygophyllaceae—	
Zygophyllum apiculatum	Pointed Twin-leaf
Zygophyllum crenatum	Notched Twin-leaf
Zygophyllum fruticulosum	Shrubby Twin-leaf
Zygophyllum glaucescens[6]	Pale Twin-leaf
Zygophyllum ammophilum[1]	Sand Twin-leaf
Zygophyllum iodocarpum[3]	Violet Twin-leaf
Nitraria Schoberi	Nitre Bush
Tribulus terrestris	Caltrop
Rutaceae—	
Phebalium glandulosum	Desert Phebalium

Polygalaceae—

Bredemeyera scoparium[5]	Broom Milkwort

Euphorbiaceae—

Bertya Mitchellii[4]	Olive Bertya
Beyeria Leschenaultii	Pale Turpentine Bush
Beyeria opaca	Dark Turpentine Bush
Euphorbia Drummondii	Flat Spurge
Phyllanthus lacunarius[1]	Lagoon Spurge

Sapindaceae—

Heterodendron oleifolium	Cattle Bush or Cabbage Bush
Dodonaea stenozyga[4]	Desert Hop Bush
Dodonaea cuneata	Wedge-leaf Hop Bush
Dodonaea bursariifolia[4]	Small Hop Bush
Dodonaea attenuata	Slender Hop Bush

Rhamnaceae—

Cyptandra amara[5]	Bitter Cryptandra
Cyptandra leucophracta[4]	White Cryptandra
Spyridium subochreatum	Velvet Spyridium

Sterculiaceae—

Lasiopetalum Behrii	Pink Velvet Bush
Lasiopetalum Baueri[4]	Slender Velvet Bush

Leguminosae—

(Caesalpinoideae)—

Cassia eremophila	Desert Cassia or Boronia
Cassia Sturtii	Dense Cassia or Boronia

(Mimosoideae)—

Acacia spinescens	Spiny Acacia
Acacia calamifolia	Wallowa
Acacia acanthoclada[5]	Harrow Acacia
Acacia obliqua	Spoon Acacia
Acacia montana	Mallee Acacia
Acacia microcarpa	Manna Acacia
Acacia salicina[1]	Willow Acacia
Acacia ligulata	Small Cooba
Acacia hakeoides	Hakea Acacia
Acacia pycnantha	Golden Wattle
Acacia colletioides	Wait-a-while
Acacia rigens	Nealie or Cat Bush
Acacia homalophylla	Myall
Acacia farinosa	Mealy Acacia
Acacia sclerophylla	Hard-leaf Acacia
Acacia stenophylla[1]	Eumong or Weeping Wattle
Acacia trineura	Three-nerved Acacia
Acacia Victoriae	Bramble Acacia
Acacia Oswaldii	Umbrella Acacia

(Papilionatae)—

Swainsona microphylla	Small-leaf Swainson Pea
Swainsona phacoides	Dwarf Swainson Pea
Swainsona reticulata	Netted Swainson Pea
Swainsona laxa[3]	Straggling Swainson Pea
Swainsona Greyana[1]	Darling Pea
Swainsona procumbens[1]	Pretty Swainson Pea
Platylobium obtusangulum	Common Flat Pea
Templetonia egena	Round Templetonia
Templetonia sulcata[4]	Flat Templetonia
Aotus villosa[5]	Common Aotus
Lotus australis[1]	Austral Trefoil
Eutaxia microphylla[4]	Eutaxia
Psoralea tenax	Tough Scurf Pea
Psoralea eriantha	Woolly Scurf Pea
Glycyrrhiza acanthocarpa[1]	Southern Liqourice
Trigonella suavissima	Sweet Fenugreek

Malvaceae—

Plagianthus Berthae[4]	Uncommon Plagianth
Lavatera plebeja	Austral Hollyhock
Sida corrugata	Dwarf Sida
Abutilon Theophrasti[1]	Swamp Chinese Lantern
Abutilon otocarpum	Desert Chinese Lantern

Dilleniaceae—

Hibbertia stricta	Erect Guinea Flower

Frankeniaceae—

Frankenia angustipetala[6]	Thyme Sea Heath
Frankenia foliosa[6]	Leafy Sea Heath

Violaceae—

Hybanthus floribundus[4]	Shrub Violet

Thymelaeacaceae—

Pimelea microcephala	Small-head Rice Flower
Pimelea simplex	Desert Rice Flower

Lythraceae—

Ammania multiflora[1]	Jerry-jerry

Myrtaceae—

Eucalyptus odorata var calcicultrix[1]	Box
Eucalyptus incrassata	Yellow Mallee
Eucalyptus dumosa	Dumosa Mallee
Eucalyptus oleosa	Red Mallee or Oil Mallee
Eucalyptus rostrata[1]	River Red Gum
Eucalyptus gracilis	White Mallee
Eucalyptus calycogona	Red Mallee
Eucalyptus Behriana	Bull Mallee
Eucalyptus leucoxylon	Yellow Gum

Eucalyptus bicolor[1]	Black Box
Eucalyptus viridis	Green Mallee
Callistemon brachyandrus[1]	Prickly Bottle Brush
Melaleuca uncinata	Broom Honey Myrtle
Melaleuca pubescens	Moonah
Melaleuca halmaturorum[6]	Kangaroo Paper-bark
Melaleuca acuminata[4]	Creamy Honey Myrtle
Leptospermum coriaceum	Green Tea Tree
Baeckea Behrii[5]	Broom Heath Myrtle
Baeckea crassifolia[5]	Desert Heath Myrtle
Calythrix tetragona	Common Fringe Myrtle
Onagraceae—	
Jussieua diffusa	Clove-strip
Halorrhagidaceae—	
Loudonia Behrii[5]	Golden Pennants
Halorrhagis heterophylla	Rough Raspwort
Halorrhagis odontocarpa[4]	Toothed Raspwort
Myriophyllum verrucosum	Red Water-milfoil
Myriophyllum propinquum	Water-milfoil
Umbelliferae—	
Didiscus cyanopetalus	Blue Didiscus
Daucus glochidiatus	Austral Carrot
Epacridaceae—	
Leucopogon cordifolius[4]	Heart-leaf Beard-heath
Oleaceae—	
Jasminum lineare[2]	Desert Jasmine
Gentianaceae—	
Limnanthemum crenatum	Wavy Marshwort
Erythraea spicata	Austral Centaury
Asclepiadaceae—	
Marsdenia australis	Austral Doubah
Convolvulaceae—	
Convolvulus erubescens	Blushing Bindweed
Cuscuta tasmanica	Tasman Dodder
Cressa cretica	Rosinweed
Boraginaceae—	
Halgania cyanea	Rough Halgania
Halgania lavandulacea	Lavender Halgania
Cynoglossum australe	Austral Hounds-tongue
Cynoglossum suaveolens	Sweet Hounds-tongue
Plagiobothrys elachanthus	Hairy Forget-me-not
Lappula concava	Burr Stickseed
Heliotropium europaeum[1]	Common Heliotrope
Heliotropium curassavicum[1]	Smooth Heliotrope

Verbenaceae—

Verbena officinalis[1]	Common Vervein

Labiatae—

Ajuga australis	Bugle Plant
Prostanthera chlorantha	Green Mint Bush
Westringia rigida	Stiff Westringia
Teucrium racemosum	Grey Germander
Teucrium sessiliflorum	Camel Bush
Teucrium racemosum var tripartitum	Grey Germander
Mentha australis[1]	River Mint
Mentha satureioides[1]	Creeping Mint

Solanaceae—

Nicotiana suaveolens	Austral Tobacco
Lycium australe[3]	Austral Boxthorn
Solanum simile	Oondoroo
Solanum esuriale	Quena
Solanum nigrum[1]	Black Nightshade
Solanum lacunarium[1]	Desert Nightshade
Anthocercis myosotidea[5]	Small-leaf Ray-flower

Scrophulariaceae—

Glossostigma elatinoides	Small Mud-mat
Mimulus prostratus	Small Monkey-flower
Veronica peregrina	Wandering Speedwell
Limosella Curdieana	Large Mudwort
Morgania glabra[1]	Smooth Morgania

Myoporaceae—

Eremophila glabra	Dwarf Emu-bush
Eremophila crassifolia[4]	Thick-leaf Emu-bush
Eremophila scoparia	Silvery Emu-bush
Eremophila maculata	Spotted Emu-bush
Eremophila oppositifolia[2]	Twin-leaf Emu-bush
Eremophila bignoniiflora[1]	Bignonia Emu-bush
Eremophila longifolia	Berrigan
Eremophila divaricata[1]	Spreading Emu-bush
Eremophila Sturtii[3]	Turpentine Emu-bush
Eremophila polyclada[1]	Twiggy Emu-bush
Myoporum deserti[4]	Turkey-bush
Myoporum platycarpum	Sugarwood or Sandalwood
Myoporum montanum[1]	Water-bush
Myoporum parvifolium[1]	Creeping Myoporum

Plantaginaceae—

Plantago varia	Variable Plantain

Rubiaceae—

Asperula wimmerana[1]	Wimmera Woodruff
Asperula gemella[1]	Twinleaf Woodruff

Cucurbitaceae—

Melothria micrantha	Mallee Cucumber

Campanulaceae—

Wahlenbergia gracilis	Austral Blue-bell
Lobelia pratioides	Poison Lobelia

Goodeniaceae—

Goodenia geniculata	Bent Goodenia
Goodenia pinnatifida	Cut-leaf Goodenia
Goodenia subintegra	Silky Goodenia
Goodenia glauca	Pale Goodenia
Goodenia heteromera	Spreading Goodenia
Goodenia varia	Sticky Goodenia
Goodenia robusta	Woolly Goodenia
Dampiera lanceolata	Grooved Dampiera
Dampiera rosmarinifolia[3]	Rosemary Dampiera
Scaevola spinescens[2]	Prickly Fan-flower

Compositae—

(Astereae)—

Olearia rudis	Azure Daisy-bush
Olearia magniflora[3]	Splendid Daisy-bush
Olearia Muelleri	Dusky Daisy-bush
Olearia pimeleoides	Pimelea Daisy-bush
Olearia subspicata	Spiked Daisy-bush
Olearia teretifolia	Slender Daisy-bush
Olearia lepidophylla[4]	Club-moss Daisy-bush
Olearia decurrens[2]	Clammy Daisy-bush
Olearia ramulosa[4]	Twiggy Daisy-bush
Brachycome calocarpa	Lobe-seed Daisy
Brachycome graminea	Grass Daisy
Brachycome pachyptera	Hard-head Daisy
Brachycome ciliaris[2]	Fringed Daisy
Calotis cuneifolia[1]	Bindi-eye
Calotis erinacea	Tangled Burr-daisy
Calotis hispidula	Hairy Burr-daisy
Calotis anthemoides[1]	Common Burr-daisy
Calotis scapigera[1]	Tufted Burr-daisy
Minuria leptophylla	Minnie Daisy
Minuria integerrima	Smooth Minuria
Vittadinia triloba	New Holland Daisy

(Inuleae)—

Myriocephalus Stuartii	Ham-and-Eggs Daisy
Myriocephalus rhizocephalus	Woolly-heads
Helichrysum apiculatum	Common Everlasting
Helichrysum bracteatum	Golden Everlasting
Helichrysum leucopsidium[4]	Satin Everlasting
Helichrysum retusum	Rough Everlasting
Helichrysum semipapposum	Clustered Everlasting

Craspedia uniflora	Common Billy-buttons
Craspedia pleiocephala	Soft Billy-buttons
Helipterum anthemoides	Camomile Sunray
Helipterum polygalifolium[2]	Milkwort Sunray
Helipterum variabile[2]	Golden Sunray
Helipterum corymbiflorum	Paper Sunray
Helipterum floribundum	Flowery Sunray
Helipterum pygmaeum	Pigmy Sunray
Helipterum moschatum	Musk Sunray
Helipterum Jesseni	Orange Sunray
Helipterum demissum	Tiny Sunray
Gnaphalium japonicum	Common Cudweed
Gnaphalium luteo-album	Jersey Cudweed
Waitzia acuminata	Orange Immortelle
Millotia tenuifolia	Soft Millotia
Ixiolaena leptolepis[6]	Stalked Ixiolaena
Podosperma angustifolium	Sticky Long-heads
Athrixia tenella	Wirewort
Calocephalus Sonderi	Pale Beauty-heads
Calocephalus Drummondii	Dwarf Beauty-heads
Angianthus strictus[3]	Stiff Cup-flower
Angianthus pusillus[4]	Dwarf Cup-flower
Angianthus brachypappus[6]	Spreading Cup-flower
Podolepis capillaris	Wiry Podolepis
Gnephosis skirrophora[6]	Woolly Gnephosis
Cassinia arcuata[2]	Drooping Cassinia
Gnaphalodes uliginosum	Flannel Cudweed
Leptorhynchus tetrachaetus	Beauty Buttons
Leptorhynchus panaetioides[1]	Woolly Buttons
Eriochlamys Behrii[6]	Woolly Mantle
(Anthemideae)—	
Cotula coronopifolia[6]	Water-buttons
Centipeda Cunninghamii[1]	Common Sneezeweed
Centipeda thespidioides	Desert Sneezeweed
Centipeda minima[1]	Spreading Sneezeweed
Isoetopsis graminifolia[3]	Grass Cushion
Ceratogyne obionoides	Wingwort
(Senecioneae)—	
Senecio lautus	Variable Groundsel
Senecio Cunninghamii	Branching Groundsel
Senecio platylepis	Toothed Groundsel
Senecio brachyglossus[6]	Slender Groundsel
(Heliantheae)—	
Eclipta platyglossa[1]	Yellow Twin-heads
(Cichoreae)—	
Microseris scapigera[6]	Yam

By Authority: J. J. Gourley, Government Printer, Melbourne.